Impact of Iron Fortification of Soy Sauce on the Micronutrient Status of the Chinese Population - An Efficacy Trial

FINAL TECHNICAL REPORT

Chinese Center for Disease Control and Prevention

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Final Technical Report of the MI Project " Impact of Iron Fortification of Soy Sauce on the Micronutrient Status of the Chinese Population - An Efficacy Trial"

Background

The Micronutrient Initiative (MI) has approved the proposal entitled " Impact of Iron Fortification of Soy Sauce on the Micronutrient Status of the Chinese Population - An Efficacy Trial" prepared by the Chinese Academy of Preventive Medicine (CAPM) and submitted by ILSI International in 1999. An agreement of the project (MI File No. 5800-0005-64-300) was signed by MI and CAPM in February, 2000, with a project duration of two years and 624,300 Canadian dollars funding from MI. Because of the delayed receiving (in April 2000) of the first payment and the late arrival of imported instruments, the planned field works were delayed and completed in April, 2002, i.e. two months after the deadline indicated in the Agreement. Due to the large amount of data generated from the trial and adding new outcome measurements after April 2002, CAPM has requested three times of extension of time without supplementary funding, till the end of April 2003. These requests were approved by MI (Appendix 1).

Since 2002, the CAPM was changed to the name of "Chinese Center for Disease Control and Prevention" with no change in affiliation and functions. The research team remains the same.

Project objectives

The overall purpose of the project was to determine whether or not soy sauce fortified with NaFeEDTA is an effective intervention to combat iron deficiency and iron deficiency anemia in China. The specific objectives include:

1. To evaluate the impact of iron fortified soy sauce on the iron status of the selected Chinese population,
2. To evaluate the impact of iron fortified soy sauce on the vitamin A status of the selected Chinese population,
3. To evaluate the impact of iron fortified soy sauce on the anthropometric variables of the selected Chinese population.

Study design and methods

The study was a randomized double-blind controlled intervention trial conducted in rural populations of Bijie city, Guizhou province. The subjects in the active (intervened) group were given iron fortified soy sauce and subjects in the control group were given non-fortified soy sauce of the same brand and quality. The intervention was continued for one and a half year, and the indicators of iron status, vitamin A status and child growth (physical and mental) were measured at the baseline and during the intervention period. Food consumption data was also collected. The effectiveness of iron fortified soy sauce in controlling iron deficiency and anemia in the subjects was assessed by comparing all the results between the active group and the control group.

Study site and subjects

Haizijie town of Bijie city, Guizhou province was selected as the study site, and nine villages in the Haizijie town were selected as study villages, based on the following selecting criteria: located in the same geographical setting; near to each other with a distance of 300-400 meters apart; relatively high household density; similar economy level and nationality; and very cooperative.

The 9 villages were randomly divided into two groups, i.e. the active group, provided with iron fortified soy sauce; and the control group, provided with non-fortified soy sauce (Figure 1). The two groups of village are evenly located in either side of the small road with a total population of about 14,000 and 3,000 households. The population of the two groups was basically similar (6,332 vs. 7,684) (Table 1). These residents were provided with soy sauce at no cost. Most of the subjects were farmers.

Among the total number of residents who were provided with soy sauce, about 4,500 were invited to participate in the baseline survey. The demographic features of the baseline survey participants are described in Tables 2-5.

Consent forms

The township and village leaders have submitted an application to the Health Department of Bijie city to show their willingness to participate in this nutrition improvement trial on behalf of the residents in the 9 villages, and an official approval document from the Health Department of Bijie city was issued (Appendix 2).

Township and village leaders have conducted several village meetings with the participation of all adult residents to explain about the trial and every resident were allowed not

to participate in the trial. The teachers of the village schools also explained to the students about the trial.

The reason of using this approach instead of individual consent forms was mainly due to the fact that a large proportion of the village residents are illiterate.

Soy sauce supply

NaFeEDTA was selected as the iron fortificant and the concentration of iron added to soy sauce was designed to be 26.7 mg/100 ml, based on our previous bioavailability and efficacy studies in humans. Both the fortified and non-fortified soy sauce were provided by the Beijing Huwang-Hetiankuan Food Company in Beijing with the same brand (Jinshi) and quality. NaFeEDTA was provided by Beijing Vita Company manufactured according to the proprietary technology developed by Dr. J. Huo and his colleagues at the Institute of Nutrition and Food Hygiene, CAPM. The quality of NaFeEDTA is in compliance with the JECFA specifications.

The two types of soy sauce carried the same label, but with different colors, i.e. the yellow label for fortified soy sauce and green label for non-fortified soy sauce. Only the investigator who was in charge of the soy sauce production and supply knew which color represented iron-fortified soy sauce and which color represented non-fortified soy sauce. Other investigators, including the PI and local team members and village leaders were "blind".

The amount of iron provided to the sample population per adult per day was designed to be 4 mg Fe in the form of NaFeEDTA. This was based on the results from the efficacy study which showed that 5 mg Fe was effective for treating anemia within 2-3 months.

Based on the pre-trial survey results and a discussion among the investigators, it was decided that the amount of soy sauce to be provided to the subjects was 15 ml per capita per day. The following factors were taken into account in this decision: a. the national average consumption of soy sauce was 12 ml per person per day; b. the survey results on soy sauce consumption from the sample population at the study site (20 ml per person per day) (Appendix 3); and c. budget constraints - for compliance considerations, soy sauce was provided to subjects at no cost. The soy sauces were distributed to the participants once a month on household basis by a designated village staff (e.g. women leader) with detail documentation. Records of soy sauce distribution were kept at village level. The supply of soy sauce was started in the middle of September, 2000 on village basis, according to the progress of the baseline survey.

Variables observed

The variables observed during the trial and the time-table are as follows.

Variables	Baseline	6-month	12-month	18-month
Hemoglobin	X	X	X	X
Hematocrit	X		X	
Ferritin	X		X	
Protoporphyrin	X		X	
Serum VA	X		X	
Dietary survey	X	X	X	X
Anthropometry	X		X	
Mental development				X
Physical endurance				X

A detailed sampling plan was prepared and agreed by the local team.

- Blood samples (40% of the total subjects)

1. The sampling of approximately 40% households was based on the sampling of students, i.e. if a student is chosen. his (her) family will also be chosen. Adjustment was made on age distribution between the 2 groups.
2. Sampling was taken place class by class in all the schools until enough households were chosen. Most classes in the schools were sampled.
3. Distribution between ages (3-6, 7-18, 19-54 and ≥55 y) and sexes was checked and adjusted as feasible.
4. For feasibility reasons, finger tip blood was collected in young preschool children (3-6 y.); and intravenous blood (2-3 ml) was collected from other age groups.
5. Whole blood Hb and hematocrit, serum ferritin and RBC Zn protoporphyrin were measured in the 40% blood samples. At 6-month and 18-month, only finger tip blood hemoglobin was measured.
6. Serum vitamin A was measured in 20% of the subjects > 6 y.
7. Hb, hematocrit and Zn protoporphyrin were measured at the local laboratory of the local team. Serum ferritin and vitamin A were measured at the Institute of Nutrition and Food

Hygiene, CAPM, Beijing. The serum samples were shipped from Bijie to Beijing on dry ice by airplane and stored at -80°C prior to testing.

- Dietary survey (food frequency questionnaire) was carried out in 20% of the subjects at the baseline survey and the 1-year follow-up -- about 500 households were chosen from the 40% households from which blood samples were collected; all household members (except < 3 y.) were included in the survey. During the 6- and 18-month follow-up, about 10% of the subjects provided dietary information.
- Anthropometry: height and weight were measured in 40% of the total sample (all age groups), plus every preschool children (3-6 y) and school children taking soy sauce. Arm circumference and skin folds (triceps, biceps and abdominal) were measured in all subjects in the 3-6 and 7-12 year-old groups.
- Mental development tests - Clinical Memory Scale (CMS) was tested in 9-13 year-old school children and the Gessell Development Schedule was tested in 0-3 year-old young children.
- Physical endurance (the step test) was carried out in women of 19-30, 31-54 and ≥55 year-old women.
- The methods of blood analysis, anthropometry, mental development, physical endurance and dietary survey are included in Appendix 4.

Changes in study design after one year of intervention

The duration of the intervention in the original plan was 2 years. However, the effectiveness of controlling anemia prevalence and improvement of child growth was quite convincing after one year of intervention. After consulted with several international experts and also approved by MI, the following changes were made.

- For ethical reasons, the intervention was ended at 18 months after the trial was started, and the control group was given iron fortified soy sauce for 6 months.
- Cognitive development assessment was conducted in children in both active and control groups during the 18-month follow-up.
- Physical endurance (step test) was assessed in female women of child-bearing age and school children in both active and control groups during the 18-month follow-up.
- To measure serum transferrin receptor (TfR) in selected subjects (about 400 subjects) based on age, sex and changes of hemoglobin level in both active and control groups, using the

serum samples collected at the baseline survey and the 1-year follow-up. This was decided after the completion of the field work, based on that the remaining serum samples are well stored at -80°C and it is possible to use the remaining funds to purchase a small number of test kits. This idea was agreed by Dr. Eric Boy.

Quality control

- A working manual was prepared and used as the training material for the local working team. A three-day training course was convened in Bijie city and about 30 local team members attended the course. A pilot baseline survey was carried out by the trainees on the last day of the training course.
- All the methods used in this study were piloted and/or validated. Analytical standards and blind samples were used in all laboratory analysis. Duplicate samples were analyzed for blood hemoglobin, ferritin, and RBC Zn protoporphyrin and selected samples for serum vitamin A.
- Food frequency questionnaires were checked by local team leader. Any missing information were filled in and any possible errors were corrected before data entry. Logistic check and range check were conducted by scientists at the Institute of Nutrition and Food Hygiene, CAPM.

Results

Subjects and drop-outs

The data of all the variables were presented as various age and gender groups, i.e. 3-6 (preschool), 7-18 (school), 19-54 (adult) and ≥55 (elderly) year-old, but for females, the adult group was further divided into 19-30 and 31-54 year-old groups. Because of the small number of subjects in the preschool group, the data of boys and girls are combined in certain data sets.

The total number of subjects in the 9 groups at the baseline survey (Tables 2-5) was proportionally in line in with the age and gender distribution of the total population of the 9 villages, with the exception of the 3-6 year-old group in which every possible subjects in the 9 villages was recruited in order to maximize the number of subjects in this age group. More importantly, the percentages of subjects in each age group of the active group and the control

group were basically the same (Tables 2 and 3). Similarly, the proportion of males to females in the active group and the control group was also very close (Tables 4 and 5).

During the subsequent follow-ups, the number of subjects in each group was slightly reduced. One major reason was that some subjects were not available at the time of the check-up. The second reason was that a certain number of adult male subjects left the villages to take a job outside of the township, in order to increase income. Another minor reason was that a small number of subjects refused to participate in the subsequent blood collection. The number of drop-outs, using hemoglobin assay as an example, is presented in Table 6. At the final follow-up after 18 months of intervention, 86.2% of the subjects in the active and 94.0% of the subjects in the control group participated in the hemoglobin examination.

Soy sauce distribution and consumption

The compliance of soy sauce distribution and consumption was excellent. Each village had a designated person (women leader, accountant, village "doctor, etc." to distribute the soy sauce in 2 fixed days in every month at the village office. The amount of soy sauce shipped from Beijing to Bijie city, and distributed at the village level was shown in Table 7 and 8, respectively. And the average soy sauce consumption by the subjects as calculated from the dietary survey data was: 16.3 ml/person/day for the active group and 15.9 ml/person/day for the control group (detail information in page 12). The actual soy sauce consumption for each age and gender group is not available, because the cooking was done on household basis and it was not possible to collect individual soy sauce consumption by food frequency questionnaire survey. No other soy sauce was brought into the 9 villages, because all the village stores stopped to sale soy sauce since the beginning of the trial (see the following section - acceptability). No signs of exchanging soy sauce among the 9 villages were found, especially between the active group and the control group, since the taste of these two soy sauces is the same.

Acceptability of iron fortified soy sauce

A specific survey on the acceptability of the tested soy sauce during the trial was conducted in 187 households (one subject each household). In general, the acceptability of the two types of soy sauce was very good, because the quality of the provided soy sauce was significantly better than the local soy sauce, which the residents used to consume. During the 18 months study period, no one complained about the organoleptic quality of the two types of soy sauce and there were no adverse effects found due to the consumption of the iron fortified soy

sauce. Table 9 presented the survey results on the flavor and taste of NaFeEDTA fortified soy sauce.

Blood hemoglobin (Hb) level and prevalence of anemia

Blood Hb was measured four times throughout the whole study. At the baseline survey and the one-year follow-up, blood Hb was measured using intravenous blood and during the 6-month and 18-month follow-up, Hb was measured using finger-tip blood. It is known that the Hb levels measured from intravenous blood and finger-tip blood could be different and thus not comparable, and also greater variations could occur by measuring finger tip blood. Keeping this in mind, the main comparison was carried out between the active group and the control group at each check-up and the comparison between baseline and after 6-, 12- and 18-months is of secondary importance. The changes of Hb level in each age and gender group throughout the whole trial period were presented in Tables 10 and Figures 2-3. The results clearly show that after 6 months of intervention, the Hb level was significantly higher in each age and gender group of the active group than those of the control group. On the other hand, the Hb level in each age and gender group of the active group was significantly increased after 6 months of intervention, and in the control group the increase of Hb level was much less than that of the active group.

Anemia was diagnosed based on the level of blood hemoglobin according to the WHO criteria, i.e. 3-6 year-old, <110 g/L; >6-12 year-old, <120 g/L; and >12 year-old, <130 (male) and <120 (female) g/L. Prevalence of anemia was calculated for each age and gender group and the results were presented in Table 11 and Figures 4-5. The data clearly show that after 6 months of intervention, the anemia prevalence was significantly lower in each age and gender group of the active group than those of the control group. On the other hand, the anemia prevalence in each age and gender group of the active group was significantly reduced after 6 months of intervention, and in the control group the decrease of anemia prevalence was much less and in certain groups (e.g. 3-6 year old) there was virtually no reduction. Among the various age and gender groups in the active group, the improvement was most significant in the 3-6 and 7-18 year-old groups for males and 3-6 and 19-30 year-old in females.

In order to answer the question of whether there are other etiological causes of anemia than iron deficiency in the study site, hook worm infection was investigated in local children, since pernicious malaria was never reported in Guizhou province. The examination of stool

samples during the baseline survey revealed that among the 4,056 subjects examined, the prevalence of hook worm infection was only 2%. In addition, the significant reduction of anemia prevalence by NaFeEDTA fortified soy sauce clearly indicate that iron deficiency is the main cause of the anemia in the study site.

Serum ferritin

The data on serum ferritin levels in each age and gender group of the active group and the control group was presented in Tables 12 and Figures 6. After one year of intervention, the increase of ferritin levels in male subjects in all the 4 age groups (except the ≥=55 year-old group) of the active group was significantly higher than those of the control group; and the increase of ferritin levels of female groups in 3 age groups (3-6, 7-18 and 19-30 year-old) was significantly higher than those of the control group. However, unexpectedly, the ferritin levels of the older age group in both males and females of the control group were higher than those of the active group. No specific reasons were found for this discrepancy. The overall results indicate that the iron storage was significantly improved after the intervention with iron fortified soy sauce.

Blood hematocrit

The data on hematocrit levels in each age and gender group of the active group and the control group was presented in Tables 13. No differences in baseline hematocrit data were found between the active group and the control group. After one year of intervention, it was found that in the male subjects, all age groups in the active group had higher hematocrit levels than that of the control group, but only the results from one group (19-54 year-old group) was statistically significant. However, in female subjects, hematocrit levels in all age groups (except the 31-54 year-old group) of the active group were significantly higher than those of the control group. Although the changes in hematocrit were not as significant as blood hemoglobin, the data show that hematocrit level was improved after iron fortified soy sauce intervention. On the other hand, the data showed that hematocrit levels are closely correlated with hemoglobin levels (Table 14),

RBC Zn protoporphyrin

The data on RBC Zn protoporphyrin levels in each age and gender group of the active group and the control group was presented in Tables 15. No sensible interpretations could be made on these results which show that Zn protoporphyrin levels increased significantly after one year of intervention, and the levels were higher in most age and gender groups of the active group than those of the control group. No analytical errors were found. This is a new method for

us and it was the first time that we used this instrument (ZP Hematoflurometer, Model 206 D, AVIV Biomedical Compamny, USA). According to the instructions accompanying the instrument, it could be used to measure iron deficiency. After several consultations with experts in iron nutrition, we did not have a satisfactory explanation to these unexpected results.

Serum retinol (vitamin A)

The purpose of measuring serum retinol is to find out whether improving iron status by iron fortification would also improve vitamin A status of the subjects. The data presented in Tables 16 show that no significant differences were found between all the age and gender groups of the active group and the control group after one year of intervention. On the other hand, using < 30 μg/dl as the cut-off point for subclinical vitamin A deficiency and < 20 μg/dl for clinical vitamin A deficiency, a large proportion of subjects could be diagnosed as vitamin A deficiency, especially in the 7-18 year-old group; although there were no significant differences between the active group and the control group (Table 17). There was an overall moderate improvement of serum retinol level in both groups after one year of intervention, but the reasons are not clear.

Physical development of preschool children

Height and weight were the main indicators for assessing proper growth of the 3-6 year-old children in this study. The main statistical comparison was made between the active group and the control group after one year of intervention. The results from the 3-6 year-old group (Table 18) show that the height and weight of the active group was marginally significantly higher than those of the control group at the baseline survey. However, after one year of intervention, the Z scores of weight for age, weight for height and height for age of the active group were higher than those in the control group (Figure 7), but only the difference in weight for age was statistically significant.

Height and weight were measured for every subject in all the age and gender groups who gave blood. No significant results were found in other age and gender groups than preschool children and the data are presented in Appendix 5.

Other anthropometric data

Arm circumference and skin folds (triceps, biceps and abdominal) were measured in the 3-6 year-old (preschool) group and 7-18 year-old group (Table 19 and 20). In all the age and gender groups, there were no significant differences in arm circumference and skin folds measurements between the active group and the control group, except in 3-6 and 7-18 year-old

groups (both genders) that the abdominal skinfold values were higher in the control group than the active group. After one year of intervention, the triceps and abdominal skinfold measurements in the two age groups (both genders) of the active group increased significantly as compared with the baseline data; however, no significantly changes were observed in the two age groups of the control group (Figure 8). These findings are consistent with the increase of body weight and height in the 3-6 year-old children in the active group.

Mental development

Mental development assessment was divided into cognitive development and learning ability assessment in children. The results of the Clinical Memory Scale (CMS) tested in 9-13 year-old school children and the Gessell Development Schedule tested in 0-3 year-old young children are presented in Tables 21-23. No significant differences were found in cognitive development between the active group and the control group after 18 months of intervention.

Physical endurance

Physical endurance was measured in adult female subjects by a simple step test, because sophisticated instruments are not feasible to use in the study site. The results are presented in Tables 24. The only significant finding is that the physical endurance was significantly better in the old age active group than the old age control group. However, the sample size was too small to draw solid conclusion. No significant differences were found in physical endurance between the other age groups of the active group and the control group after 18 months of intervention.

Dietary assessment

Individual food frequent questionnaire (FFQ) was administered to all subjects on selected household basis. A sample of the FFQ form is included in Appendix 6. There were four times of FFQ survey to the same households throughout the trial, i.e. at baseline and 6-, 12- and 18-month. The summary results of food consumption for each age and gender group are presented in Appendix 7.

Table 25 shows the average iron intake of the subjects at baseline survey. In consistent with other studies conducted in China, the dietary iron intake of local residents reached 110-180% of the Chinese RDA, which indicates that the poor iron status of the subjects was mainly due to the poor availability of iron in the plant food-based diet.

Selected food consumption data at baseline and one year after intervention are presented in Figures 9-12. The overall results show that there were no significant differences in the amount

of animal or plant foods consumed and the dietary pattern between all the age and gender groups of the active group and those of the control group both at the baseline survey and also after one year of intervention. The amount of food consumed and the dietary pattern in both the active group and the control group remained the same throughout the trial period.

Soy sauce consumption and additional iron intake from NaFeEDTA fortified soy sauce

The soy sauce consumption was estimated on household basis and roughly divided among the house members, based on the FFQ data. Therefore, only average consumption data throughout the trial is presented in Table 26. The data show that the soy sauce consumption increased from 14.3 ml/person/day (before trial) to 16.5 ml/person/day in the active group and from 14.1 ml/person/day (before trial) to 15.8 ml/person/day in the control group. Most of the average consumption values are slightly higher than the planned 15 ml per person per day, because for feasibility considerations, the actually soy sauce supply to the households is one bottle (500 ml) per month for each person, i.e. 16.7 ml (30 days/month) or 16.1 ml (31 days/month) per month.

The additional iron intake from NaFeEDTA fortified soy sauce of various age and gender groups, calculated based on the average added NaFeEDTA to soy sauce (Table 27) is presented in Table 26. The average iron intake from NaFeEDTA fortified soy sauce based on the three surveys was estimated to be 4. 9 mg per person per day.

Serum transferrin receptor

Due to the long process of getting the final compilation of hemoglobin data and the long duration of ordering TfR test kits from USA, this test has not been completed yet. The results will be submitted in the next couple of months. However, this would not affect the evaluation of the effectiveness of the intervention trial.

Quality control of laboratory blood analysis

Quality control results in blood hemoglobin, serum ferritin, RBC Zn protoporphyrin and serum retinol using blind samples are presented in Figures 13-16. Blind samples were analyzed in daily work with the samples from the study subjects. The overall results show that the quality of laboratory analysis met the requirements of laboratory assay.

Cost considerations of applying NaFeEDTA fortified soy sauce in controlling ID and IDA

The cost of NaFeEDTA is around 6 USD per kg. Assuming that 2.1 g of NaFeEDTA is added into 1 kg of soy sauce (i.e. 273 mg Fe per Kg of soy sauce) and the recommended average

soy sauce consumption is 5 kg/person/year (i.e. 1.37 g NaFeEDTA/person/year or 3.8 mg Fe/personj/day), the additional cost of NaFeEDTA to soy sauce consumer is about 0.08 USD/person/year. The cost of additional equipment (mixing tank, pipline, etc.) for the production of NaFeEDTA fortified soy sauce and laboratory analysis (QA) is very little. And the fortification technology is simple and straightforward; therefore, the supply of NaFeEDTA is not a problem.

Project organization

The project was conducted and organized by a three-tier team approach, i.e. CAPM, Quizhou province and Bijie city.

The CAPM team, headed by Dr. Junshi Chen, was responsible for: detail study design (based on the original research proposal); preparation of methods, instruments and supplies; preparation of working manual; training local team members; supply of soy sauce; monitoring the progress of field work and providing technical assistance to local team; laboratory analysis of serum ferritin and retinol; calculation of dietary data; data cleaning, compilation and interpretation; and preparation of reports to MI. There were 16 scientists in this team and a name list for the team members is enclosed in Appendix 8. Members of this team have visited the study site (and participated in the field work) for 20 person-times. And the duration of each trip varied from 3 days to 2 weeks. The Office of the ILSI Focal Point in China provided important logistic support in fund transfer to the Institute of Nutrition and Food Hygiene, CAPM. And Mme. Chen Chunming, in the roles of the Director of ILSI Focal Point in China as well as the senior scientific advisor to CAPM provided technical guidance to the project.

The Guizhou provincial team was comprised of 2 scientists from the provincial Sanitary and Anti-epidemic Station headed by Dr. Shishun Wang. It main responsibilities were: to obtain support from the provincial health department and Bijie city; responsible to CAPM for the field works conducted in Bijie city, including assisting in study site selection: to serve as the liaison between CAPM and Bijie city: and to help organizing local training course. A name list for the team members is enclosed in Appendix 8.

The Bijie city team was the major working force of the field trial and its main responsibilities were: to communicate to the township and village leaders about the significance of the project and detail operation of the project: to help the township and village leaders to mobilize subject participation at village level; to implement the working plan, including field

survey, laboratory assays and data entry; blood sample temporary storage and shipping to CAPM; and data transfer to CAPM. The Bijie city team was comprised of 45 people and headed by Mr. Shenhua Deng, Director of the Health Department of Bijie City and Dr. Qilliang Luo, Deputy Director, Bijie City Sanitary and Anti-epidemic Station. A name list for the team members is enclosed in Appendix 8.

In order to make sure that the project will get strong support from the local authorities. a letter of support and approval was sent from the Guizhou Provincial Health Department to CAPM. The Bijie city has set up a leading group headed by the Vice Mayor Ms. Shihui Peng to assure that the project will be carried out smoothly. The leading group was comprised of 11 people, including the responsible officials of Bijie city and Haizhijie town as well as directors of city health institutions and township hospitals.

A project summary meeting participated by the major members of the three-tier teams was convened on September 24 and 25, 2002 in Beijing. After the review of all the data obtained from the study, achievements and problems were discussed. One outstanding problem was the subject participation in the follow-up survey after 6, 12 and 18 months, which caused reducing number of subjects as the project progressed. The local team has worked very hard to visit individual households after the ending of group check-up at the village office or village doctor office.

Discussion and conclusions

The overall objective and the three specific objectives have been reached. The results clearly demonstrate that:

1. The NaFeEDTA fortified soy sauce at the level of 29.6 mg Fe per 100 ml soy sauce and an average soy sauce consumption of 16.5 ml per person per day was very effective in increasing blood hemoglobin and hematocrit levels and reducing anemia prevalence in all age and gender groups. and it is also effective in improving iron status as indicated by the increase of serum ferritin levels. In addition. it is also effective in improving the physical growth of preschool children as indicated by the increase of body weight and height. Therefore. it could be concluded that an average of 4.9 mg Fe per person per day from NaFeEDTA fortified soy sauce is able to control iron deficiency (ID) and iron deficiency anemia (IDA) in high risk populations in China. It should be emphasized that the effect of controlling ID and IDA by NaFeEDTA soy

sauce intervention was found to be significant within 6 months. One possible explanation to why this small amount of iron could result in such a significant effect is that the intake of NaFeEDTA may have facilitated the bioavailability of the non-heme iron in the plant food-based diet. Although this is a reasonable hypothesis, further research is needed to provide direct evidence for it. If this is true, the use of NaFeEDTA as a preferable iron fortificant should be promoted intensively, especially in poor areas where plant foods are staples.

2. The impact of NaFeEDTA fortified soy sauce on body weight increase was more pronounced than that on body height. This is consistent with the findings in other nutrition intervention studies on growth retardation children in China, which showed that body height improvement was usually behind body weight improvement (1-3). And also, one year is too short to observe a statistically significant improvement in body height with such a relatively small sample size. Therefore, it is convincing that the NaFeEDTA fortified soy sauce has beneficial effects on the physical growth of children in poor areas where growth retardation is an outstanding issue. According to the criteria of growth retardation (HAZ < -2) and wasting (WHZ < -2) using the Z score approach, the proportion of growth retardation and wasting in the 2-5 year-old children in this study (sample size 262) was 47 and 8.8%, respectively at the baseline survey, which is much higher than the 32 and 3.6% reported in the same age children in the 1992 national nutrition survey (sample size 8,395).

3. One important finding in this study is the significant effects of NaFeEDTA fortified soy sauce in 3-6 year-old preschool children. One of the common questions against using soy sauce as the vehicle for iron fortification is that young children do not consume much soy sauce. Although it was not possible to collect accurate soy sauce consumption information for this age group, the effectiveness observed in this study clearly indicates that at least in poor rural areas of China, iron fortified soy sauce is effective even in young children who may consume less soy sauce than the adults.

4. The results from dietary survey demonstrate that there were virtually no changes in the amount of foods consumed and the dietary pattern in both the active group and the control group among the four times of dietary survey. In addition, no significant differences in food consumption and dietary pattern were found between the active group and the control group throughout the whole study period. Therefore, the only difference between the active group and the control group was the consumption of NaFeEDTA fortified soy sauce and non-fortified soy

sauce. These dietary survey findings strongly support the conclusion that it was the NaFeEDTA fortified soy sauce that makes the difference.

5. The baseline survey confirmed that the study population had high prevalence of IDA (Table 11). However, the anemia of most study subjects was mild (within 10 or 15 g/L below the cut-off points) (Figure 17) and only 27 subjects (%) had blood hemoglobin level less than 90 g/L. This may account for the significant reduction of anemia prevalence after one-year of intervention; and also this may be the general feature of ID and IDA in China. Since Bijie city is one of the areas in China with the highest prevalence of anemia, the effectiveness of NaFeEDTA fortified soy sauce in controlling ID and IDA could be extrapolated to other parts of China.

6. It was reported in some studies that the improvement of iron status of subjects would also improve vitamin A status (4). However, the negative findings in retinol levels (vitamin A status) after one-year intervention does not support that hypothesis, although subclinical vitamin A deficiency is quite common tin the study subjects. It is concluded that iron fortified soy sauce does not have significant impact on the vitamin A status of the study population.

7. The adverse effects of ID and IDA on cognitive development and learning ability of children are well documented (5). However, in this study, no significant impact on cognitive development and learning ability of children was found after one-year of intervention, even though their iron status was significantly improved and anemia prevalence was markedly reduced. The possible explanation to this observation is that the time of nutrition improvement is not long enough.

8. Proposed future research projects

- The data in this study show that as little as 4.9 mg of iron from NaFeEDTA resulted in significant improvement in hemoglobin level and anemia prevalence. The hypothesis of EDTA-Fe facilitate the bioavailability of non-heme iron in the plant food-based diet should be further investigated.

- Most age and gender groups of the control group showed increase of hemoglobin level and reduction of anemia prevalence, although the changes were not as significant as the active group. Since there were no significant changes in food consumption before and after the intervention, soy sauce was the only variable in the diet, i.e. the soy sauce used in the trial is in better quality than the local soy sauce. It may be worthwhile to study

whether good quality soy sauce could facilitate the bioavailability of dietary iron in plant food-based diet.

- The reason of why there was high prevalence of anemia in the older age group, both in males and females, need further research. In addition to the smaller food consumption, the role of other micronutrients, such as vitamin B12 and folate, should be taken into account. The less effectiveness in the older age group to the iron fortified soy sauce also suggests that there may be other causal factors than iron deficiency.

Impact on the application of NaFeEDTA fortified soy sauce in national nutrition improvement program in China

The results from this intervention trial provided convincing evidence for the Ministry of Health to start the operational phase of using NaFeEDTA fortified soy sauce in national nutrition improvement program. On September 24, 2002, the Ministry of Health held a news release conference launching the production and marketing of NaFeEDTA fortified soy sauce. The outcomes of this effectiveness trial served as the main justifications for the promotion of NaFeEDTA fortified soy sauce. The recommended amount of NaFeEDTA added to the soy sauce is basically the same as that used in the effectiveness trial, i.e. 175-210 mg NaFeEDTA (23-27 mg Fe) per 100 ml soy sauce. The results of improving iron status, reducing anemia prevalence and child growth retardation are being quoted widely in educational materials (e.g. brochures, posters, exhibition boards, etc.) as well as in TV and broadcasting programs.

The results from the effectiveness study have been used as critical supporting information in two operational proposals on NaFeEDTA fortified soy sauce submitted by the Chinese government to relevant international sponsors, i.e. the country investment plan (CIP) submitted to Asian Development Bank, and the operational research proposal submitted to the GAIN. While the ADB CIP is still under evaluation, the GAIN proposal was "conditionally approved". in April, 2003.

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3. Capital Pediatric Institute and the Nine-City Child Growth Survey Cooperation Group (1998) Studies on the physical development of children under 7 year-old in nine cities in 199, Chin Med J 78:187-191. (in Chinese)
4. Tanumihardjo, S.A. (2002) Vitamin A and iron status are improved by vitamin A and iron supplementation in pregnant Indonesian women, J Nutr. 132:1909-1912.
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Figure 1. Village location

Y: Active group
G: Control group

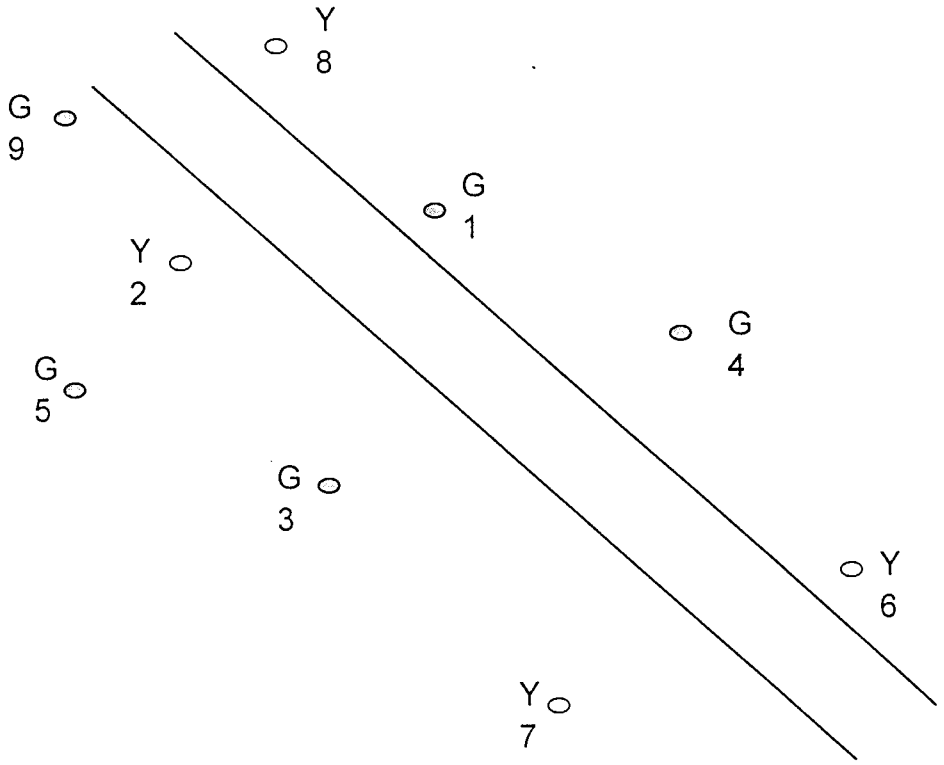
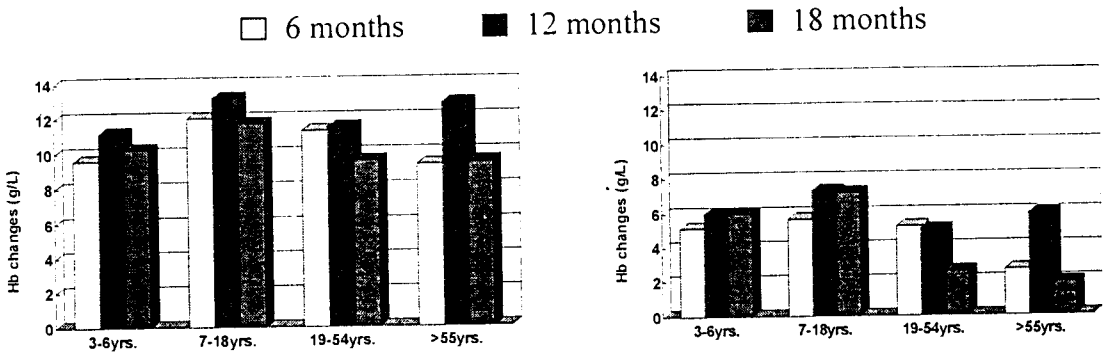


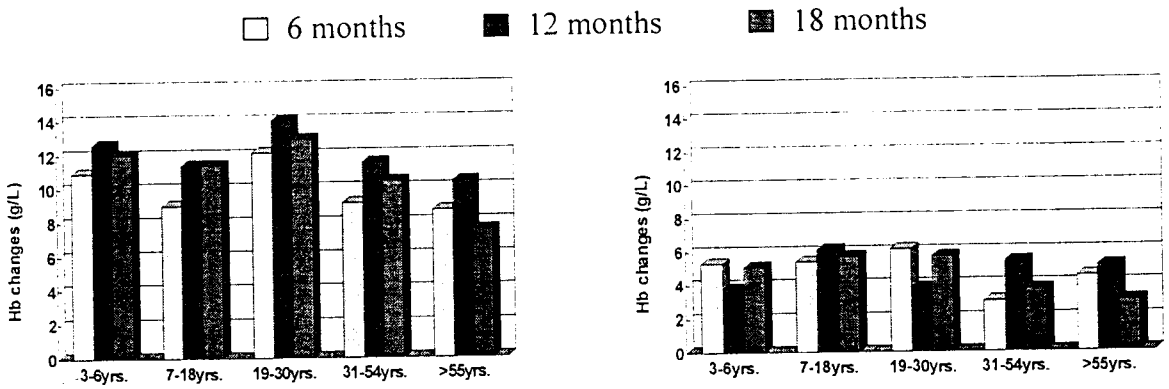
Figure 2. Changes in Hb level after 6 months, 12 months and 18 months intervention (male)



Active group

Control group

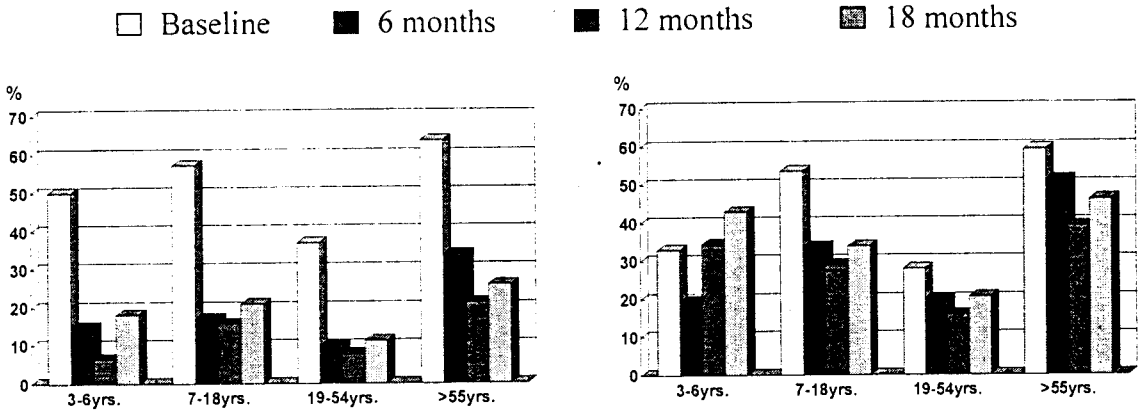
Figure 3. Changes in Hb level after 6 months, 12 months and 18 months intervention (female)



Active group

Control group

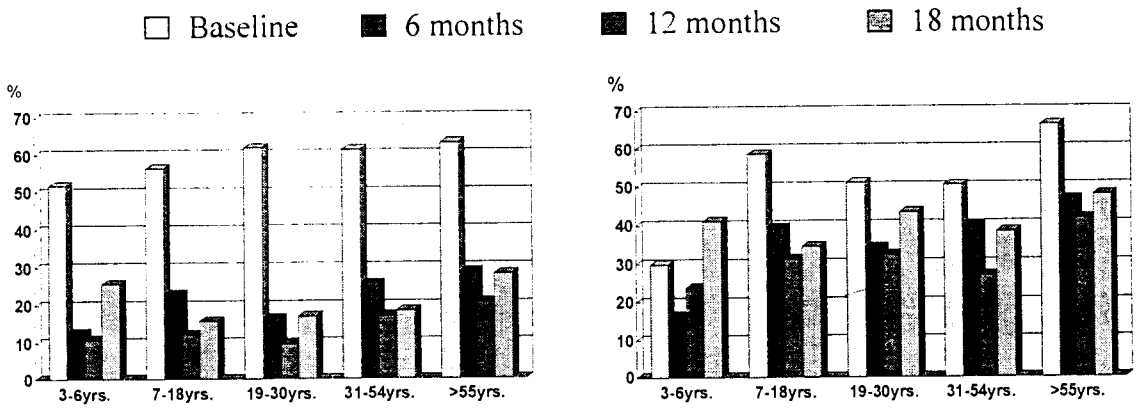
Figure 4. Changes in anemia prevalence (%) after 6 months, 12 months and 18 months intervention (male)



Active group

Control group

Figure 5. Changes in anemia prevalence (%) after 6 months. 12 months and 18 months intervention (female)



Active group

Control group

Figure 6. Changes in Serum ferritin levels (μg/L) after 12 months intervention

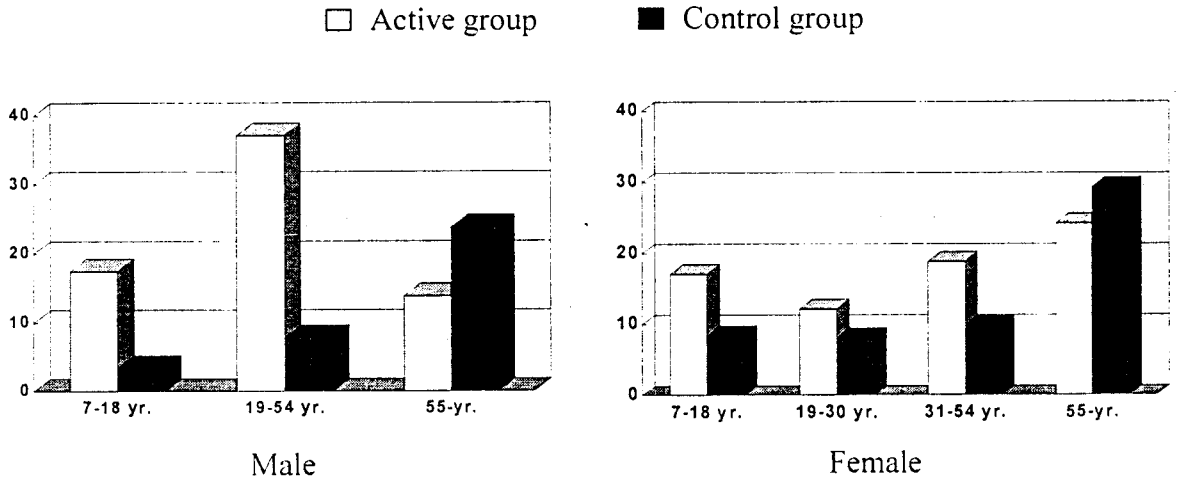
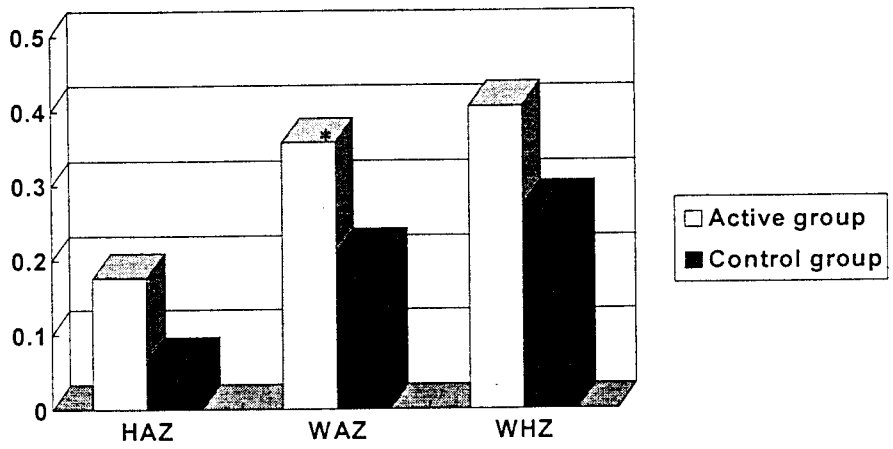
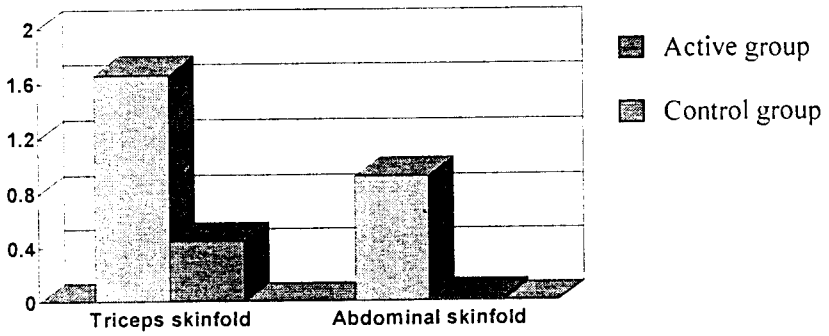


Figure 7. Changes in height and weight in 3-6 year-old children between baseline and one year after intervention

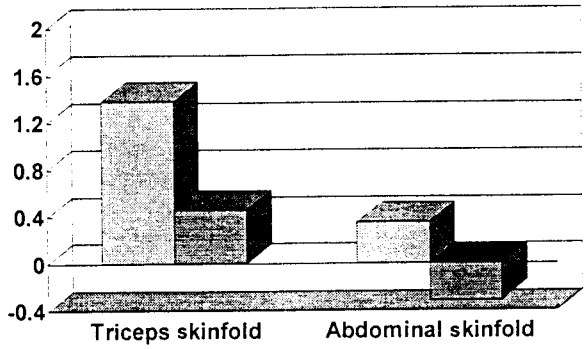


* Compare with control group, $p < 0.05$

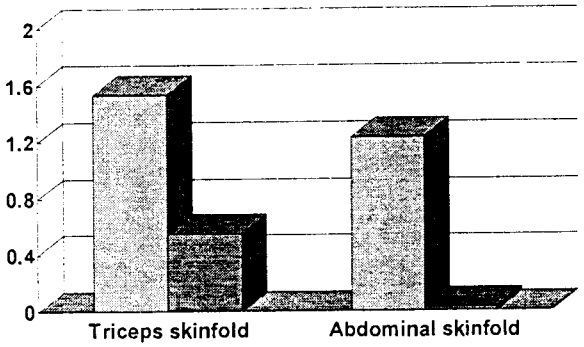
Figure 8. Changes in triceps and abdominal skinfolds (mm) after one year intervention



3-6 year-old



7-12 year-old (male)



7-12 year-old (female)

Figure 9. Food consumption in 3-6 year-old children (g/person/day)

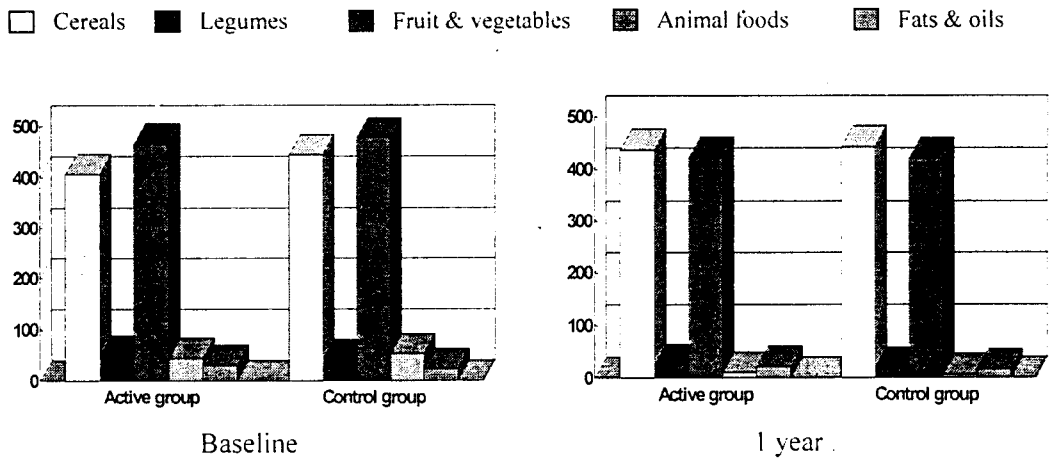
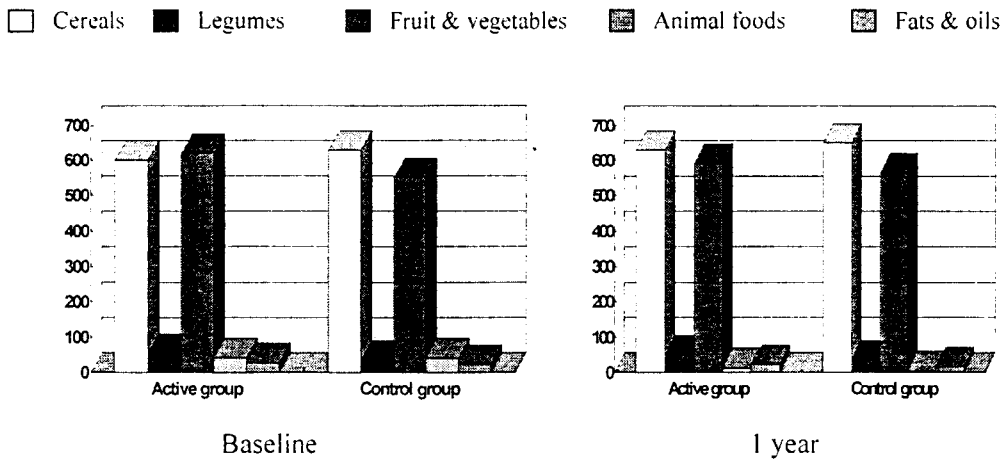


Figure 10. Food consumption in 7-18 year-old group (g/person/day)

Male



Female

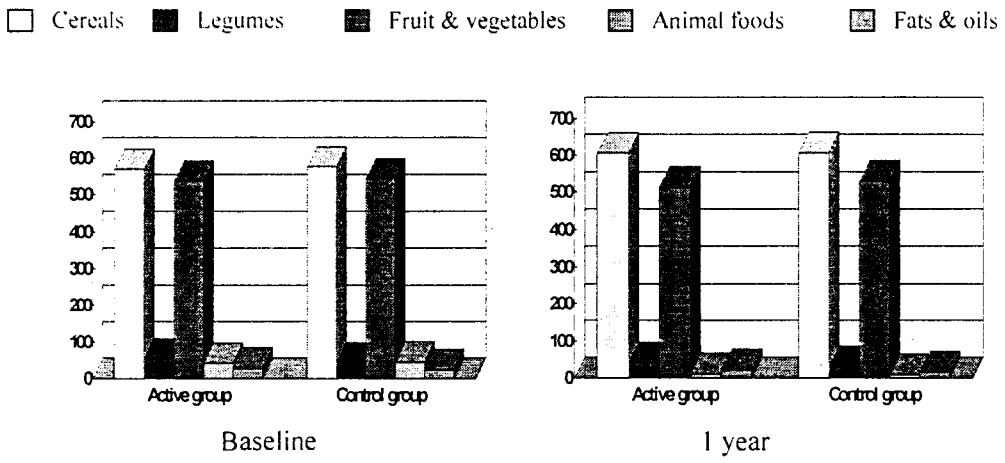
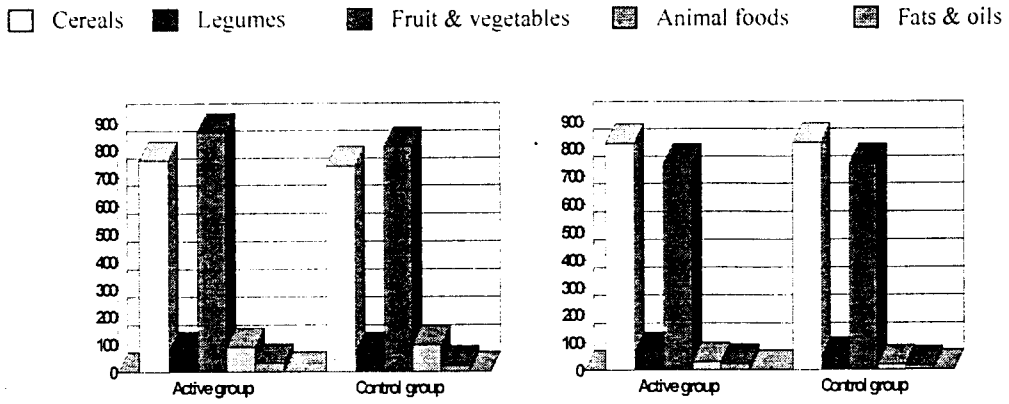


Figure 11. Food consumption in 19-54 year-old group (g/person/day)

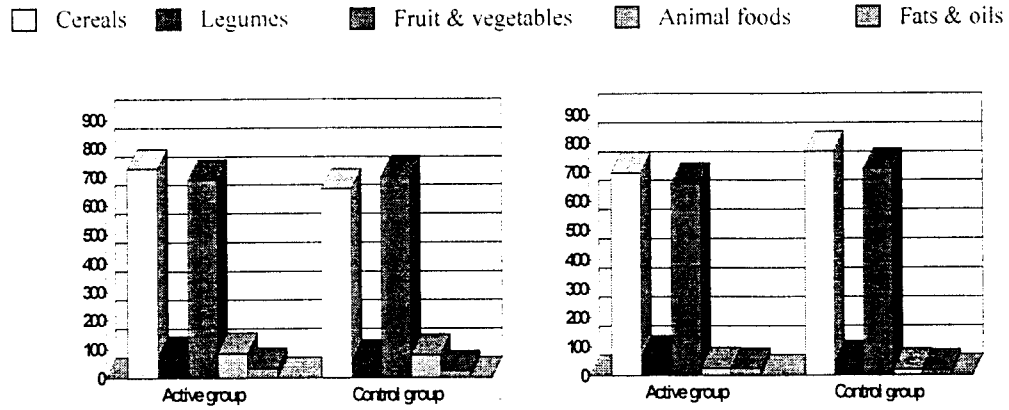
Male



Baseline 1 year

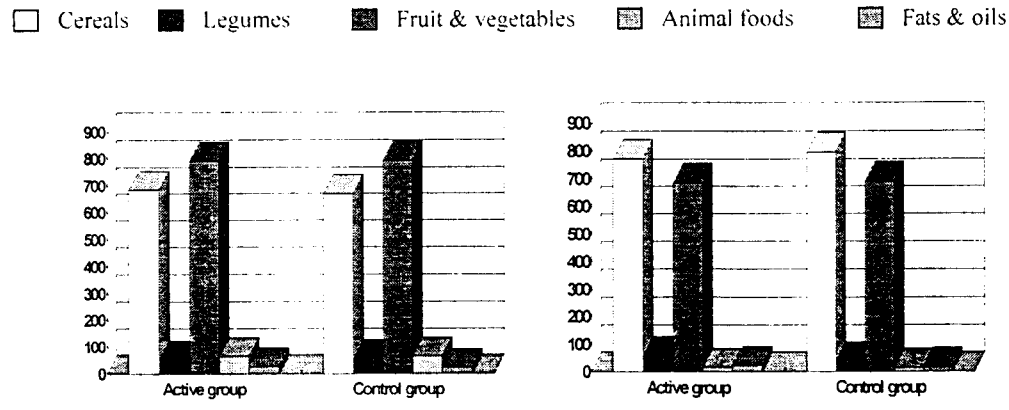
Female

Food consumption in 19-30 year-old group (g/person/day)



Baseline 1 year

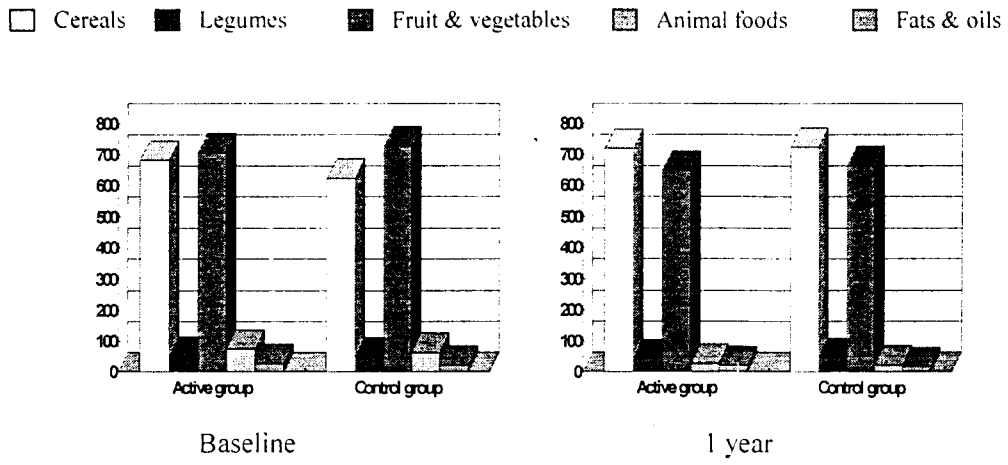
Food consumption in 31-54 year-old group (g/person/day)



Baseline 1 year

Figure 12. Food consumption in >=55 year-old group (g/person/day)

Male



Female

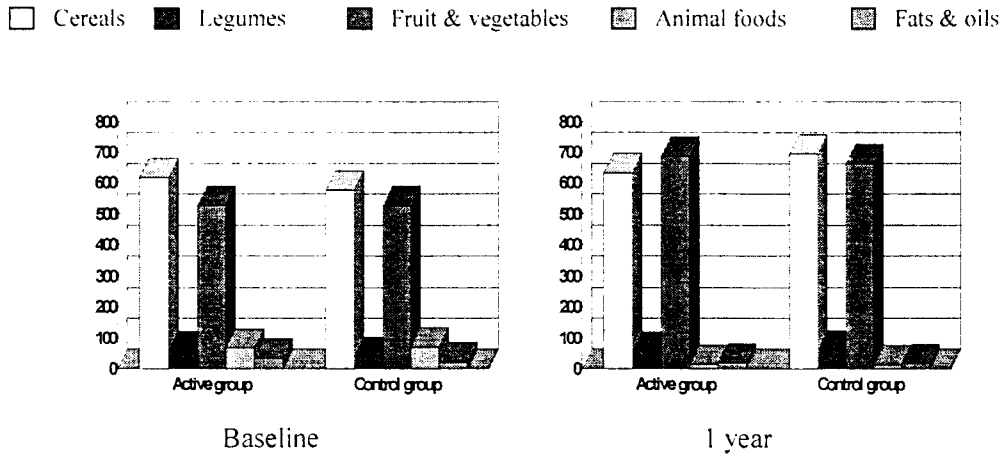
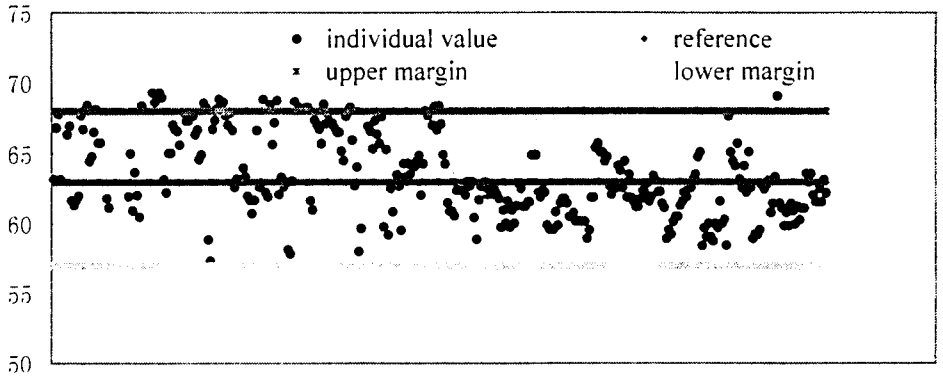
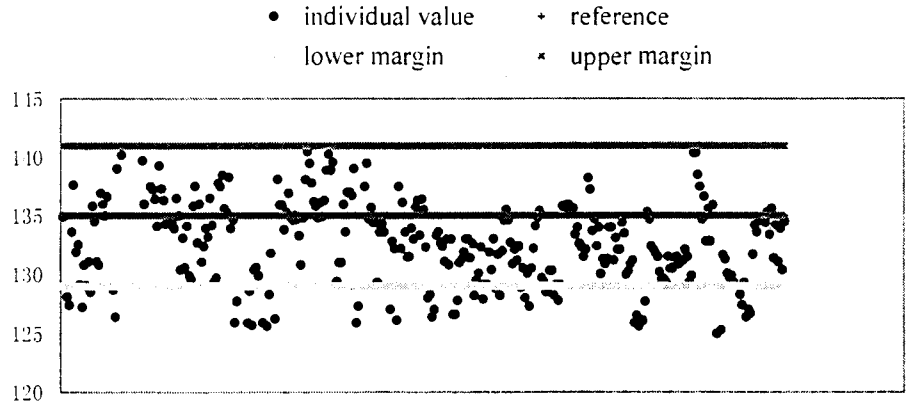


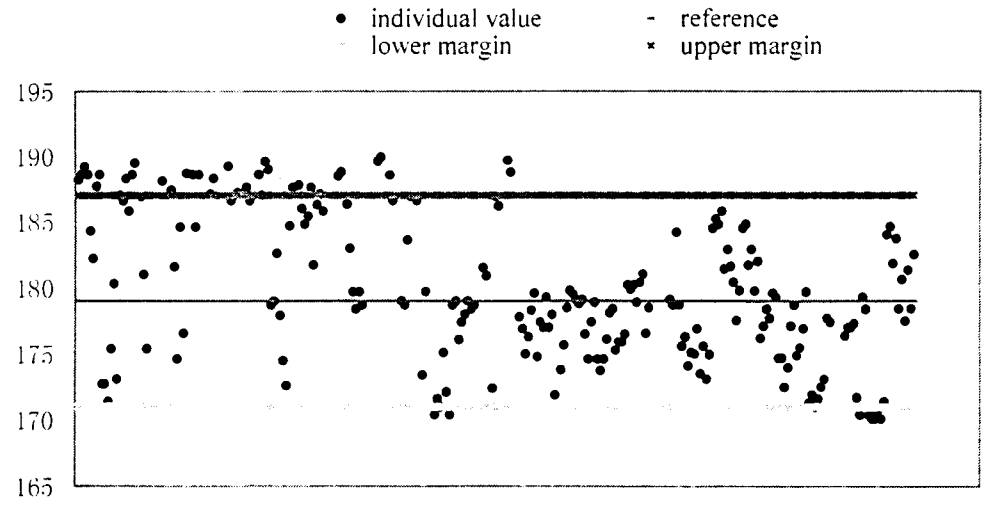
Figure 13. Quality control of blood hemoglobin measurement



Reference = 63±5 g/L

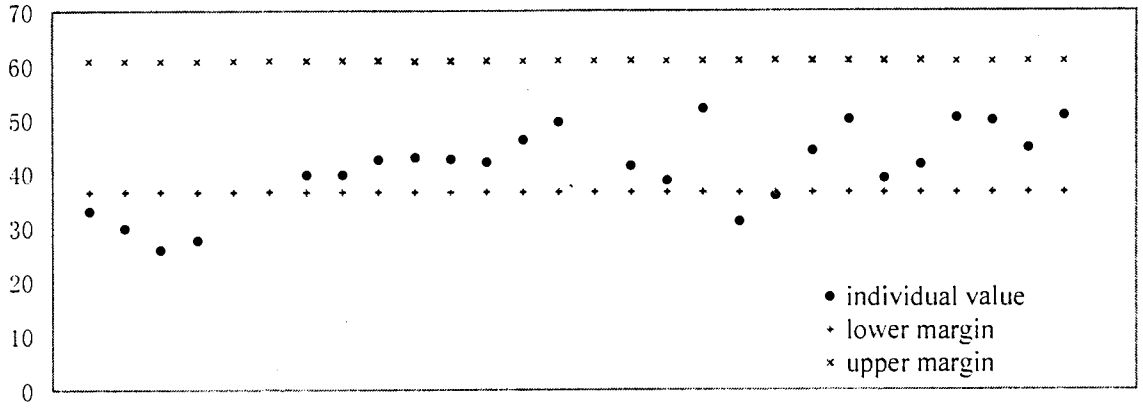


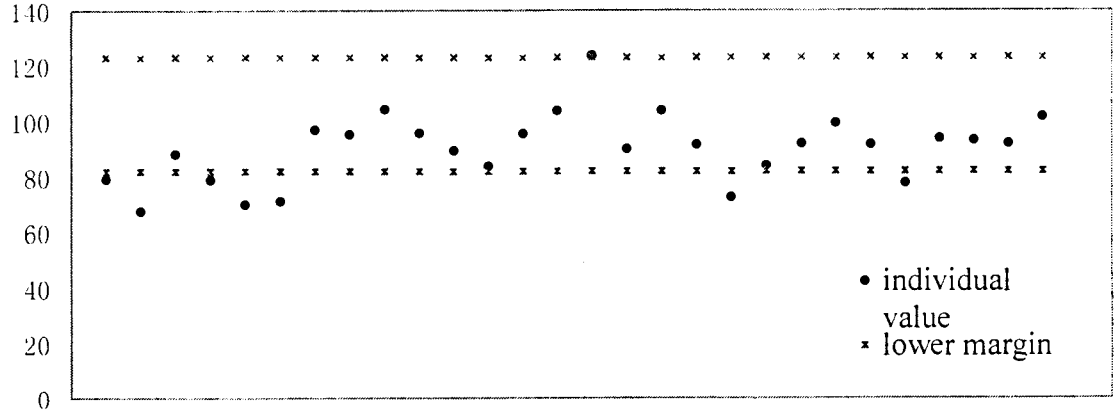
Reference = 135±6 g/L



Reference = 179±8 g/L

Figure 14. Quality control of serum ferritin (μg/L) analysis





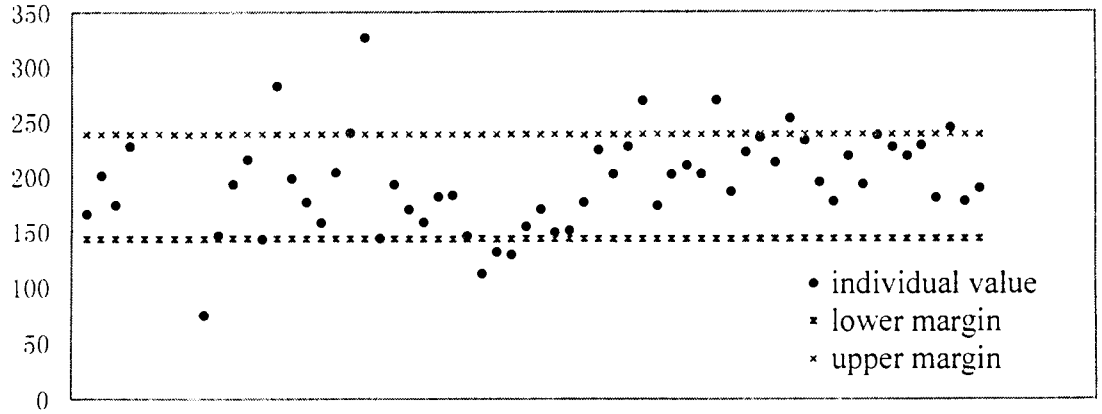
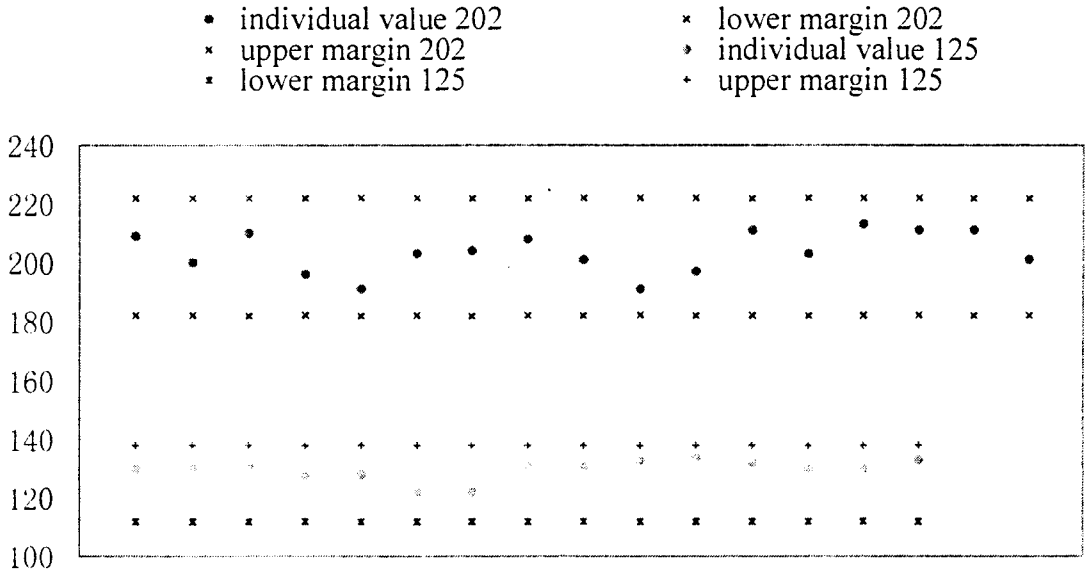
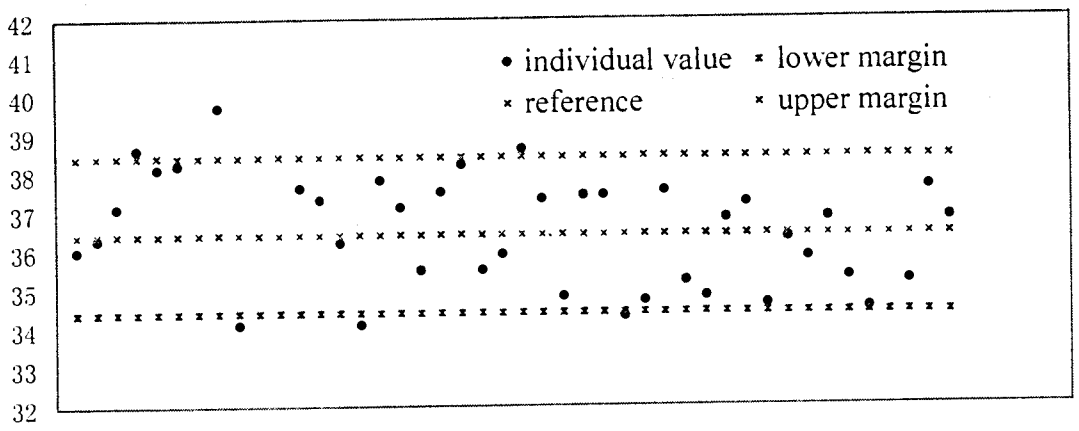


Figure 15. Quality control of RBC Zn protoporphyrin analysis

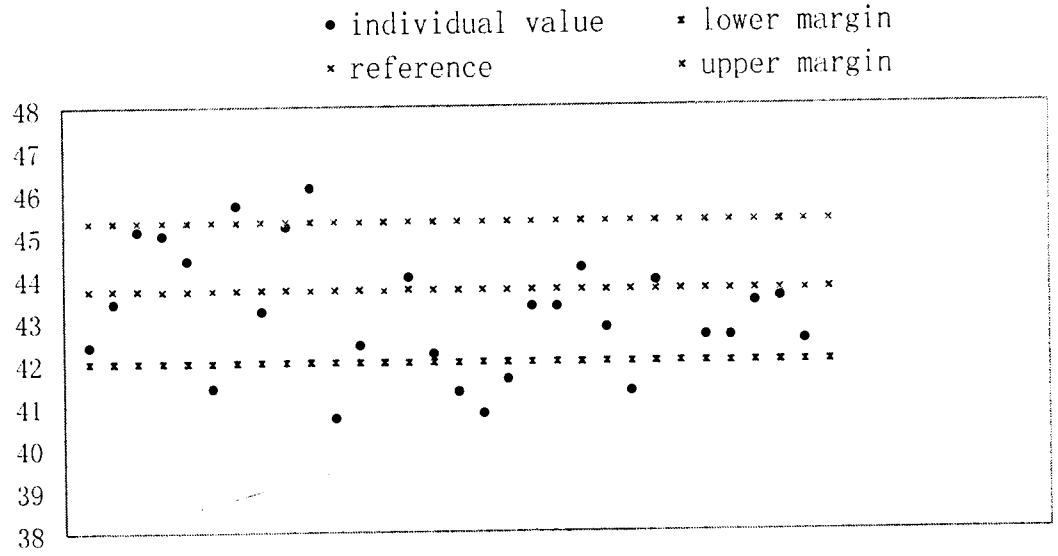


Note: quality control samples accompanied with the instrument: 125±13; 202±20.

Figure 16. Quality control of serum retinol analysis

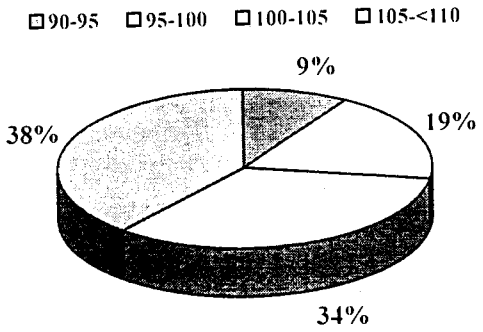


Reference = 36.4 mg/dl

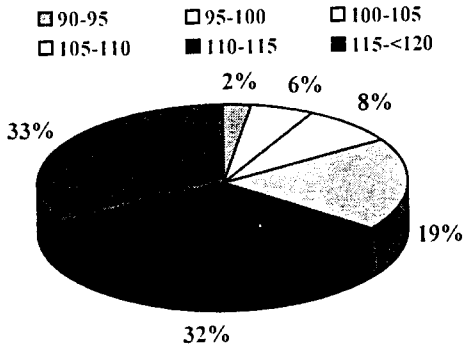


Reference = 43.7 mg/dl

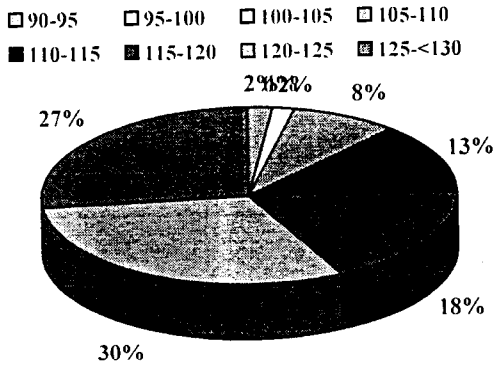
Figure 17. Percentages of anemic subjects at different Hb levels



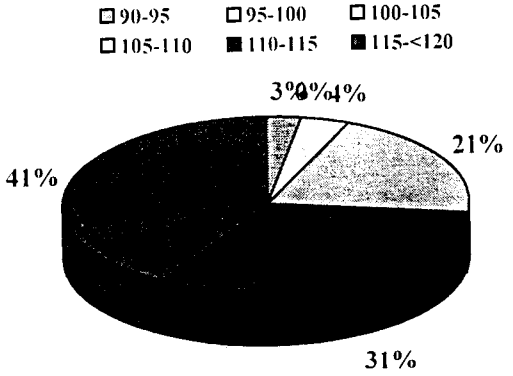
3-6 year-old (male & female)



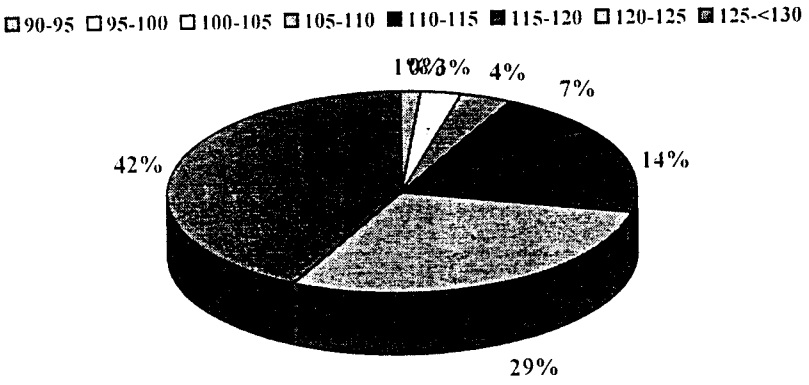
7-12 year-old (male & female)



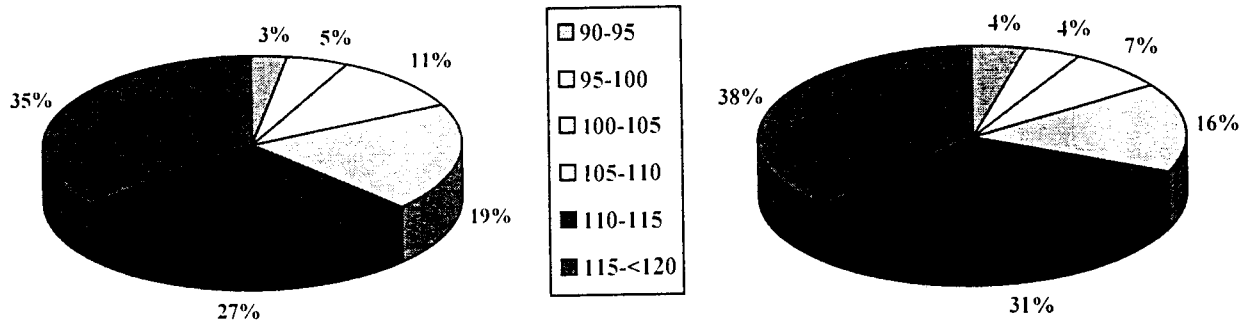
13-18 year-old (male)

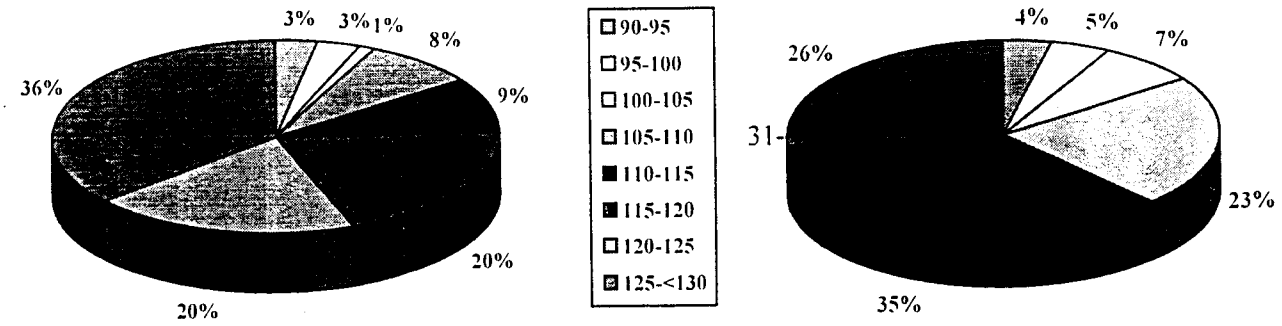


13-18 year-old (female)



19-54 year-old (male)





>55 years old (male)

>55 years old (female)

Table 1. Population in 9 selected villages in Hazijie town, Bijie city

Active Group			Control Group		
Village	Code no.	Population	Village	Code no.	Population
Dianzi	2	1,184	Shaoguan	1	2,409
Hujiayuan	6	2,023	Longtan	3	959
Chenjiayuan	7	1,997	Mahuang	4	1,661
Yingbin	8	1,128	Maguohe	5	1,354
			Qiaotoubian	9	1,301
Total		6,332	Total		7,684

Table 2. The distribution of sample population by age (Active group)

Village No.	Total population	3-6 yr.		7-18 yr.		19-54 yr.		55- yr.	
		N	%	N	%	N	%	N	%
2	396	37	9.3	151	38.2	179	45.2	29	7.3
6	945	96	10.2	382	40.4	408	43.2	59	6.2
7	845	67	7.9	319	37.8	393	46.5	66	7.8
8	174	10	5.7	34	19.5	92	52.9	38	21.8
Total	2,360	210	8.9	886	37.5	1,072	45.4	192	8.1

Table 3. The distribution of sample population by age (Control group)

Village No.	Total population	3-6 yr.		7-18 yr.		19-55 yr.		>56 yr.	
		N	%	N	%	N	%	N	%
1	595	40	6.7	233	39.2	288	48.4	34	5.7
3	371	34	9.2	137	36.9	171	46.1	29	7.8
4	425	24	5.6	157	36.9	208	48.9	36	8.5
5	419	33	7.9	186	44.4	168	40.1	32	7.6
9	337	25	7.4	117	34.7	156	46.3	39	11.6
Total	2.147	156	7.3	830	38.7	991	46.2	170	7.9

Table 4. The distribution of sample population by sex (Active group)

Village No.	Total population	Male		Female	
		N	%	N	%
2	396	178	44.9	218	55.1
6	945	478	50.6	467	49.4
7	845	447	52.9	398	47.1
8	174	82	47.1	92	52.9
Total	2,360	1,185	50.2	1,175	49.8

Table 5. The distribution of targeted population by sex (Control group)

Village No.	Total population	Male		Female	
		N	%	N	%
1	595	302	50.8	293	49.2
3	371	182	49.1	189	50.9
4	425	223	52.5	202	47.5
5	419	213	50.8	206	49.2
9	337	156	46.3	181	53.7
Total	2,147	1,076	50.1	1,071	49.9

Table 6. The number of drop-outs in the hemoglobin assay

Group	Baseline	6-months	12-months	18-months
Active	2,344	2,055	2,029	2,020
Control	2,135	1,744	2,075	2,007

Table 7. The amount of soy sauce shipped from Beijing to Bijie city

Batch	Date	Amount of soy sauce (kg)	
		Active group	Control group
1	October 8. 2000	4,000	4,000
2	November 22. 2000	3,000	3,000
3	January 11. 2000	3,000	3,000
4	March 15. 2001	6,000	6,000
5	May 17. 2001	6,000	6,000
6	July 26. 2001	6,000	6,000
7	September22. 2001	6,000	6,000
8	December 19, 2001	6,000	6,000
9	February 28. 2001	6,000	6,000
10	May 6. 2002	6,000	3,000
11	June 1. 2002	3,000	/
12	July 1. 2002	3,000	/
13	September 8. 2002	6,000	/
Total		64,000	49,000

Table 8. Soy Sauce delivered to households in 18 months by village

Active group		Control group	
Village No.	Soy sauce (kg)	Village No.	Soy sauce (kg)
2	8,600	1	6,800
6	19,000	3	10,290
7	19,000	4	8,800
8	3,240	5	16,400
		9	6,300
Total	49,840	Total	48,590

Table 9. Organoleptic acceptability of NaFeEDTA fortified soy sauce in 187 subjects

	Better		OK		Worse	
	N	%	N	%	N	%
Flavor	175	93.6	11	5.9	1	0.5
Taste	184	98.4	3	1.6	0	0

Table 10. Changes in blood hemoglobin levels (g/L) during the trial

Male

Group		3-6 yr.	7-18 yr.	19-54 yr.	55- yr.
Active	Baseline	111.2±11.6 (120)	120.2±11.9 (481)	133.4±11.5* (486)	126.2±13.2 (88)
	6 mos.	120.4±10.0[c] (94)	131.0±10.4[c***] (449)	144.6±11.6[c***] (357)	134.4±14.2[c] (89)
	12 mos.	120.9±8.5[c*] (107)	131.6±10.7[c***] (420)	145.0±10.1[c***] (390)	137.6±12.6[c] (76)
	18 mos.	118.1±9.2[c**] (116)	130.2±11.6[c***] (397)	143.2±10.5[c***] (357)	135.0±11.3[c**] (89)
Control	Baseline	112.8±9.8 (88)	121.6±10.9 (474)	135.2±11.1 (424)	128.3±13.2 (86)
	6 mos.	117.9±8.9[b] (62)	126.4±11.6[c] (415)	140.0±11.9[c] (305)	130.4±11.9 (72)
	12 mos.	116.8±10.7[a] (61)	127.8±10.7[c] (466)	139.8±10.9[c] (387)	134.1±12.2[b] (87)
	18 mos.	113.5±8.8 (70)	127.3±11.0[c] (496)	137.7±11.0[b] (345)	130.4±11.2 (91)

Female

Group		3-6 yr.	7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	110.8±10.6 (89)	118.4±10.9 (398)	116.7±11.1* (165)	116.6±10.3*** (417)	116.3±10.3 (100)
	6 mos.	121.2±11.3[c] (71)	127.0±9.6[c***] (376)	129.0±9.8[c**] (122)	125.9±10.9[c***] (403)	127.8±10.5[c**] (94)
	12 mos.	121.8±9.1[c] (75)	128.8±8.8[c***] (347)	129.5±9.3[c***] (115)	128.9±9.2[c***] (386)	127.8±9.5[c***] (82)
	18 mos.	118.3±9.1[c*] (86)	128.4±10.9[c***] (381)	128.7±10.4[c***] (124)	127.2±9.3[c***] (381)	123.5±9.9[c*] (89)
Control	Baseline	113.9±9.6 (67)	118.2±9.2 (353)	119.4±9.2 (147)	119.4±9.0 (413)	115.9±10.6 (83)
	6 mos.	118.3±10.3[a] (43)	123.4±10.5[c] (319)	125.1±10.5[c] (88)	122.4±10.2[c] (369)	120.2±9.4[c] (71)
	12 mos.	119.2±10.3[b] (46)	123.9±8.9[c] (365)	123.2±9.2[b] (139)	124.8±9.2[c] (435)	121.7±11.3[b] (89)
	18 mos.	114.7±9.0 (56)	124.8±10.0[c] (377)	122.9±10.8[b] (99)	122.5±9.4[c] (381)	120.2±9.4[b] (92)

Note: Mean±SD; numbers in brackets are number of subjects.

Compare with control group. * $p<0.05$: ** $p<0.01$; *** $p<0.001$.

Compare with baseline. a $p<0.05$; b $p<0.01$; c $p<0.001$.

Table 11. Changes in anemia prevalence (%) during the trial

Male					
Group		3-6 yr.	7-18 yr.	19-54 yr.	55- yr.
Active	Baseline	50.0	57.2	36.8	63.6
	6 mos.	14.9[c]	16.9[c]	9.8[c]	33.7[b]
	12 mos.	6.5[c]	15.7[c]	7.7[c]	21.1[c]
	18 mos.	18.1[c]	20.9[c]	11.2[c]	25.8[b]
Control	Baseline	33.0	53.6	27.8	59.3
	6 mos.	19.4	33.7[c]***	20.0*	51.4
	12 mos.	34.4**	29.0[c]**	15.8[b]*	39.1
	18 mos.	42.9*	33.9[c]**	20.6*	46.2

Female						
Group		3-6 yr.	7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	51.7	56.3	61.8	61.2	63.0
	6 mos.	12.7[c]	22.9[c]**	16.4[c]*	25.6[c]**	28.7[b]
	12 mos.	10.7[c]	12.1[c]***	9.6[c]**	17.1[c]*	20.7[c]*
	18 mos.	25.6[a]	15.7[c]***	16.9[c]**	18.4[c]***	28.1[b]
Control	Baseline	29.9	58.6	51.0	50.4	66.3
	6 mos.	16.3	39.2[b]	34.1	39.8	46.5
	12 mos.	23.9	31.2[c]	32.4[a]	26.9[c]	41.6
	18 mos.	41.1	34.5[c]	43.4	38.3[b]	47.8

Note: Compare with control group, * $p<0.05$; ** $p<0.01$; *** $p<0.001$.
Compare with baseline, a $p<0.05$; b $p<0.01$; c $p<0.001$.

Table 12. Changes in serum ferritin levels (μg/L) during the trial

Male					
Group		7-18 yr.	19-54 yr.		55- yr.
Active	Baseline	52.4±32.2 (441)	75.4±47.3 (428)		71.3±46.8 (80)
	1 year	69.2±39.2[c]*** (354)	107.3±47.2[c]*** (261)		84.1±53.4 (58)
Control	Baseline	56.5±35.0 (445)	77.0±43.0 (393)		68.6±37.2 (78)
	1 year	59.1±38.1 (384)	84.0±51.1 (274)		87.7±48.5[a] (65)
Female					
Group		7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	49.3±32.4 (369)	41.2±30.6 (156)	43.4±33.3 (381)	64.2±44.8 (95)
	1 year	66.5±44.5[c]* (291)	49.5±34.1 (97)	59.5±42.3[c]* (343)	84.8±49.6[b] (66)
Control	Baseline	48.7±30.1 (333)	38.6±26.2 (135)	46.9±30.5 (385)	65.7±43.9 (77)
	1 year	57.6±39.0[b] (299)	42.2±35.7 (116)	56.4±42.3[b] (377)	86.8±52.9[a] (68)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; *** $p<0.001$.
Compare with baseline, a $p<0.05$; b $p<0.01$; c $p<0.001$.

Table 13. Changes in hematocrit levels (%) during the trial

Male				
Group		7-18 yr.	19-54 yr.	55- yr.
Active	Baseline	40.6±3.4 (479)	44.4±3.6 (485)	42.2±4.4 (87)
	1 year	41.9±3.0 [c] (417)	46.0±3.0 [c]* (393)	44.3±3.6 [b] (72)
Control	Baseline	40.3±3.6 (470)	44.6±3.7 (420)	42.1±4.4 (84)
	1 year	41.6±3.2 [c] (449)	45.5±3.5 [b] (376)	44.2±3.4 [b] (81)

Female					
Group		7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	39.8±3.1** (395)	39.5±3.1 (165)	39.5±3.4 (416)	39.4±3.1 (99)
	1 year	41.3±2.5 [c]*** (344)	41.2±2.6 [c]* (112)	41.3±2.6 [c] (387)	41.0±3.0 [b]* (82)
Control	Baseline	39.1±3.1 (352)	39.7±3.4 (146)	39.5±3.6 (407)	38.6±3.4 (82)
	1 year	40.6±2.6 [c] (349)	40.5±2.9 [a] (130)	41.0±2.7 [c] (423)	40.0±3.2 [b] (81)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group. * $p<0.05$; ** $p<0.01$; *** $p<0.001$.
Compare with baseline. a $p<0.05$; b $p<0.01$; c $p<0.001$.

Table 14. Correlations between hematocrit levels and hemoglobin levels at baseline

Male

Group		Hb levels (g/L)	7-18 yr.	19-54 yr.	55-yr.
Active	Anemia	90-110	37.5±2.2 (74)	37.5±2.5 (11)	37.4±3.1 (10)
		110-120	39.9±2.8 (157)	41.8±3.0 (39)	39.9±2.4 (15)
		120-130	41.2±2.8 (155)	42.9±2.7 (127)	42.2±3.9 (30)
	Non-anemia	>130	42.0±3.3 (205)	45.6±3.2 (307)	44.7±4.3 (32)
Control	Anemia	90-110	36.8±2.7 (63)	40.1±5.9 (10)	37.3±3.0 (5)
		110-120	39.1±2.6 (150)	40.7±4.4 (23)	39.7±1.9 (15)
		120-130	40.9±2.6 (151)	42.1±2.6 (83)	40.9±3.0 (30)
	Non-anemia	>130	42.2±3.2 (218)	45.8±3.1 (304)	45.2±4.5 (33)

Female

Group		Hb levels (g/L)	7-18 yr.	19-30 yr.	31-54 yr.	55-yr.
Active	Anemia	90-110	37.4±2.7 (77)	36.5±2.4 (42)	37.0±3.2 (92)	37.4±2.5 (21)
		110-120	39.4±2.1 (142)	39.4±1.8 (58)	39.2±2.5 (159)	39.1±2.7 (39)
	Non-anemia	>130	41.3±3.1 (172)	41.9±2.4 (63)	41.4±3.1 (161)	41.3±2.7 (37)
Control	Anemia	90-110	36.5±2.6 (61)	36.5±3.1 (22)	36.9±2.4 (48)	36.6±2.5 (20)
		110-120	38.4±2.3 (143)	38.9±2.4 (52)	38.2±3.0 (155)	37.9±1.9 (33)
	Non-anemia	>130	40.9±2.7 (144)	41.2±3.2 (72)	41.2±3.2 (202)	41.2±3.1 (28)

Note: Mean±SD; numbers in brackets are number of subjects.

Table 15. Changes in RBC Zn protoporphyrin levels during the trial

Male					
Group		7-18 yr.	19-54 yr.		55- yr.
Active	Baseline	32.3±16.7** (478)	23.5±14.5 (484)		34.1±32.3* (90)
	1 year	49.1±15.8[c] (418)	35.1±14.2[c]* (389)		35.8±20.0 (71)
Control	Baseline	35.8±17.4 (468)	24.8±15.1 (424)		26.6±15.8 (85)
	1 year	47.9±16.7[c] (448)	32.9±13.8[c] (376)		38.4±16.8[c] (81)
Female					
Group		7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	34.9±18.4** (393)	40.6±27.6 (165)	40.7±21.4 (416)	43.0±25.7 (101)
	1 year	51.3±17.9[c] (344)	48.4±18.4[b] (112)	50.3±20.4[c] (387)	47.9±24.0 (82)
Control	Baseline	38.3±16.2 (352)	43.7±27.4 (148)	41.0±20.2 (414)	44.5±24.8 (83)
	1 year	49.4±18.6[c] (350)	48.1±22.5 (130)	50.8±21.2[c] (426)	54.3±27.6[a] (80)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; ** $p<0.01$.
Compare with baseline, a $p<0.05$; b $p<0.01$; c $p<0.001$.

Table 16. Changes in serum retinol (vitamin A) levels (μg/dl) during the trial

Male					
Group		7-18 yr.	19-54 yr.		55- yr.
Active	Baseline	18.9±8.3 (238)	34.8±13.2*** (257)		31.3±13.6 (38)
	1 year	22.5±8.5** (177)	40.9±16.2 (156)		42.2±19.9 (26)
Control	Baseline	20.2±8.6 (279)	40.2±15.5 (220)		35.8±12.6 (47)
	1 year	25.4±10.7 (223)	41.5±12.5 (152)		40.7±12.1 (38)
Female					
Group		7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
Active	Baseline	20.6±8.2 (201)	26.0±8.5 (89)	27.6±10.1 (220)	27.9±10.7 (50)
	1 year	24.3±8.6* (154)	29.7±10.6 (55)	31.2±9.9 (162)	32.8±12.5 (35)
Control	Baseline	20.5±8.5 (183)	27.7±11.2 (72)	28.6±9.9 (217)	31.5±12.7 (49)
	1 year	26.6±11.1 (143)	31.1±10.1 (57)	33.1±11.6 (184)	33.9±11.0 (37)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 17. Proportion of subjects with subclinical and clinical vitamin A deficiency during the trial

Male

Group		V_A (μg/dl)	7-18 yr.		19-54 yr.		55-yr.	
			N	%	N	%	N	%
Active	Baseline	< 20	149	62.6	27	10.3	8	22.9
		20- 30	66	27.7	73	28.0	11	31.4
		≥30	23	9.7	161	61.7	16	45.7
	1 year	< 20	72	40.7	6	3.8	1	4.0
		20-30	76	42.9	31	19.5	8	32.0
		≥30	29	16.4	122	76.7	16	64.0
Control	Baseline	< 20	152	54.5	15	6.6	4	9.8
		20-30	90	32.2	46	20.3	11	26.8
		≥30	37	13.3	166	73.1	26	63.4
	1 year	< 20	75	33.6	6	3.8	1	3.1
		20-30	83	37.2	19	12.0	3	9.4
		≥30	65	29.2	133	84.2	28	87.5

Female

Group		V_A (μg/dl)	7-18 yr.		19-30 yr.		31-54 yr.		55-yr.	
			N	%	N	%	N	%	N	%
Active	Baseline	< 20	108	53.7	24	27.0	45	19.9	12	26.1
		20-30	66	32.8	40	44.9	98	43.4	16	34.8
		≥30	27	13.5	25	28.1	83	36.7	18	39.1
	1 year	< 20	47	30.5	8	14.5	21	12.7	6	17.6
		20-30	67	43.5	23	41.8	62	37.3	9	26.5
		≥30	40	26.0	24	43.7	83	50.0	19	55.9
Control	Baseline	< 20	95	51.9	18	25.0	43	19.5	7	15.2
		20-30	58	31.7	32	44.4	98	44.6	16	34.8
		≥30	30	16.4	22	30.6	79	35.9	23	50.0
	1 year	< 20	42	29.4	7	12.3	17	9.1	1	2.9
		20-30	52	36.4	16	28.1	59	31.7	14	40.0
		≥30	49	34.2	34	59.6	110	59.2	20	57.1

Table 18. Height and weight in 3-6 year-old children

Group		Height (cm)	Weight (kg)
Active	Baseline	100.8±8.7 (203)	15.0±2.6 (207)
	1 year	105.9±9.1** (190)	17.1±2.7* (192)
Control	Baseline	102.2±10.0 (150)	15.7±4.4 (155)
	1 year	108.5±9.3 (140)	18.1±4.8 (144)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; ** $p<0.01$.

Table 19. Arm circumference and skinfolds in 3-6 year-old children

Group		Mid-upper arm circumference (cm)	Triceps skinfold (mm)	Biceps skinfold (mm)	Abdominal skinfold (mm)
Active	Baseline	15.1±1.3 (206)	8.0±1.9 (208)	5.2±1.3 (207)	3.9±1.1* (207)
	1 year	15.5±1.5 (185)	9.7±2.4*** (185)	5.0±1.2 (185)	4.8±1.8** (185)
Control	Baseline	15.2±1.4 (150)	8.0±2.7 (154)	5.3±1.7 (154)	4.2±1.5 (154)
	1 year	15.3±1.4 (140)	8.5±2.0 (140)	4.7±1.1 (140)	4.2±1.3 (140)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 20. Arm circumference and skinfolds in 7-12 year-old group

Group		Mid-upper arm circumference (cm)	Triceps skinfold (mm)	Biceps skinfold (mm)	Abdominal skinfold (mm)
Male					
Active	Baseline	17.0±1.4 (258)	7.6±2.3 (258)	5.4±1.6 (258)	4.2±1.6 (257)
	1 year	17.0±1.4 (155)	9.0±2.7*** (155)	4.8±1.4* (155)	4.5±1.9** (155)
Control	Baseline	17.1±1.6 (258)	7.4±2.7 (259)	5.2±1.5 (259)	4.2±1.4 (259)
	1 year	17.1±1.1 (129)	7.9±2.5 (129)	4.5±1.0 (129)	3.9±1.2 (129)
Female					
Active	Baseline	16.9±1.6 (209)	8.35±1.97 (209)	5.8±1.6 (209)	4.3±1.4** (209)
	1 year	16.7±1.6 (107)	9.9±2.5** (107)	5.7±1.6 (107)	5.6±2.2 (107)
Control	Baseline	17.1±1.8 (210)	8.4±2.8 (214)	6.0±2.1 (214)	4.8±1.9 (214)
	1 year	17.0±1.6 (106)	8.9±2.3 (106)	5.4±1.5 (106)	5.1±1.7 (106)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group, * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 21. DQAV values in 0-3 year-old group after 18 months intervention

Group	N	DQAV
Active	99	90.5±21.1
Control	68	92.3±11.0

Note: Mean±SD

Table 22. MQ values in 9-13 year-old school children by gender after 18 months intervention

Group	Male		Female	
	N	MQ	N	MQ
Active	122	64.1±19.8	82	58.0±17.7
Control	87	61.3±18.7	67	58.8±19.2

Note: Mean±SD

Table 23. MQ values in 9-13 year-old school children by grade after 18 months intervention

Group	3rd grade	4th grade	5th grade	6th grade
Active	63.4±14.3 (45)	64.8±19.3 (64)	53.2±21.2 (51)	65.2±16.8 (44)
Control	62.6±18.3 (30)	60.4±21.6 (77)	55.6±16.2 (21)	60.7±11.8 (26)

Note: Mean±SD; numbers in brackets are number of subjects.

Table 24. Results of step test in female subjects after 18 months intervention

Group		19-30 yr.	31-54 yr.	55- yr.
Active	Index	71.2±8.3 (21)	69.2±9.2 (67)	70.9±9.9 (38)
	Power	8.4±2.1 (21)	8.5±2.2 (67)	10.1±4.5** (38)
Control	Index	72.4±7.8 (36)	72.9±7.5 (31)	70.7±8.4 (49)
	Power	9.6±2.4 (36)	8.3±1.8 (31)	7.6±2.0 (49)

Note: Mean±SD; numbers in brackets are number of subjects.
Compare with control group. ** $p<0.01$.

Table 25. Average dietary iron intake by age and gender

	Active group			Control group		
	N	Fe intake (mg/person/day)	% RDA	N	Fe intake (mg/person/day)	% RDA
3-6 yr.	86	14.9±7.4	124	52	16.2±7.2	135
Male						
7-18 yr.	178	18.8±7.2	111	158	19.7±8.5	116
19-54 yr.	252	27.5±15.0	183	235	27.4±12.2	183
55- yr.	50	23.7±8.1	158	52	23.4±12.4	156
Female						
7-18 yr.	169	19.0±6.8	100	124	20.5±13.3	108
19-30 yr.	85	23.9±10.1	120	83	23.0±8.1	115
31-54 yr.	213	23.9±8.5	120	245	24.1±15.1	121
55- yr.	46	22.1±9.9	147	46	20.5±6.1	137

Note: Fe RDA – 3-6 year-old, 12 mg; 7-18 year-old, 17 mg (male) and 19 mg (female); 19-54 year-old, 15 mg (male) and 20 mg (female); ≥55 year-old, 15 mg. Source: Chinese Nutrition Society. Chinese DRIs. Chinese light Industry publishing House, 2002, Beijing.

Table 26. Average soy sauce and iron intake from NaFeEDTA

Group		Baseline	0-6 mos.	6-12 mos.	12-18 mos.
Active	Soy sauce intake (ml/person/day)	14.3±8.5 (1086)	17.1±2.2 (417)	16.5±3.8 (909)	16.0±2.2 (197)
	Iron intake (mg/person/day)	-	5.1	4.9	4.7
Control	Soy sauce intake (ml/person/day)	14.1±9.0 (1010)	15.6±3.1 (370)	16.0±2.4 (967)	15.8±3.2 (376)
	Iron intake (mg/person/day)	-	-	-	-

Note: Mean±SD; numbers in brackets are number of subjects.

Table 27. Measurements on the quality of soy sauce

		20010109	20010420	20011119	20020804
Salt (g/100 ml)	Fe fortified	16.70	16.72	16.52	16.70
	Non-fortified	16.70	16.72	16.52	16.70
Amino acid (g/100 ml)	Fe fortified	0.59	0.57	0.58	0.62
	Non-fortified	0.59	0.57	0.58	0.62
Total acid (g/100 ml)	Fe fortified	1.68	1.57	1.62	1.78
	Non-fortified	1.68	1.57	1.62	1.78
Non-salt solid (g/100 ml)	Fe fortified	15.50	15.27	15.51	15.47
	Non-fortified	15.50	15.27	15.51	15.47
Coliform (No. /100 ml)	Fe fortified	< 30	< 30	< 30	< 30
	Non-fortified	< 30	< 30	< 30	< 30
NaFeEDTA (g 100 ml)	Fe fortified	0.22	0.21	0.23	0.25
	Non-fortified	0.00	0.00	0.00	0.25
Organoleptic assessment	Fe fortified	OK	OK	OK	OK
	Non-fortified	OK	OK	OK	OK
Quality assessment	Fe fortified	OK	OK	OK	OK
	Non-fortified	OK	OK	OK	OK

Note: The quality criteria in the table are based on the National Soy Sauce Standard

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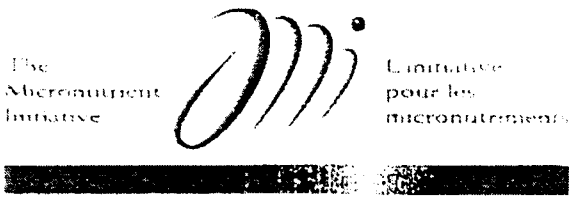
5600-0005-64-200

Contents of Appendices

Appendices

May 12, 03

Appendix 1: Letters of approval for extension of time without supplementary funding from MI



November 1, 200

Wang Kean, M.D.
Chinese Academy of Preventive Medicine
Institute of Nutrition & Hygiene
29 Nan Wei Road
Beijing 100050
People's Republic of China

Dear Dr.

Re: **Impact of Iron Fortification of Soy Sauce on the Micronutrients Status of the Chinese Population - An Efficacy Trial**
CentreMI File: 5600-0005-64-300

This letter is to inform you that the International Development Research Centre (the Centre), on behalf of the Micronutrient Initiative (MI), hereinafter referred to as the CentreMI, has authorized an extension of time, without supplementary funding, for completion of the above-mentioned Project currently being undertaken by the Chinese Academy of Preventive Medicine, hereinafter referred to as the Recipient.

The revised completion date of the Project is August 31, 2002, by which time the final scientific reports and financial statements on the Project are required.

Please note that this extension is being granted for the sole purpose of ensuring adequate allocation of time for the completion of the overall objective of the project entitled, "Impact of Iron Fortification of Soy Sauce on the Micronutrients Status of the Chinese Population - An Efficacy Trial".

We are pleased to continue our collaboration with the Chinese Academy of Preventive Medicine in this important endeavour.

Yours very truly,

Sophie Lessard
Administration Officer
Grant Administration Division
Resources Branch

encl.

SL/sm

c.c. Dr. Junshi Chen, Project Leader
International Life Sciences Institute

L'Initiative pour les micronutriments

The Micronutrient Initiative

Ottawa, Canada

April [illegible], 2002

Wang Kesan, M.D.
Chinese Academy of Preventive Medicine
Institute of Nutrition & Hygiene
29 Nan Wei Road
Beijing 100050
People's Republic of China

Dear Dr. Kesan

Re: **Impact of Iron Fortification of Soy Sauce on the Micronutrients Status of the Chinese Population – An Efficacy Trial**
Centre/MI File: 5600-0005-64-300

The purpose of this communication is to inform you that **The Micronutrient Initiative has authorized an extension of time**, without supplementary funding, for completion of the above-mentioned project currently being undertaken by the Chinese Academy of Preventive Medicine, hereinafter referred to as the Recipient.

The revised completion date of the Project is December 31, 2002, by which time the final technical reports and financial statements on the project are required.

Please note that this extension is being granted for the sole purpose of ensuring sufficient allocation of time for the completion of the overall objective of the project entitled "Impact of Iron Fortification of Soy Sauce on the Micronutrients Status of the Chinese Population – An Efficacy Trial." No resources may be shifted toward the proposed cognitive & behavioral endpoints studies.

We are pleased to continue our collaboration with the Chinese Academy of Preventive Medicine in this important endeavor.

Sincerely,

Brian Rose
Senior Program Specialist, LAC Unit
The Micronutrient Initiative, Ottawa Headquarters.

c.c. Dr. Junshi Chen, Project Leader
International Life Sciences Institute.

Initiative pour les micronutriments

The Micronutrient Initiative

Ottawa, Canada

February 10, 2003

Junshi Chen, M.D.
Institute of Nutrition and Food Hygiene
Chinese Academy of Preventive Medicine
29 Nan Wei Road
Beijing 100050
China
Tel: 86-10-6589[illegible]
Fax: 86-10-6375[illegible]

Dear Dr. Chen:

Re: **Second No-Cost Time Extension - Grant Agreement:" Impact of Iron Fortification of Soy Sauce on the Micronutrient Status of the Chinese Population: - An Efficacy Trial"**
MI File: [illegible]

The purpose of this communication is to inform you that **The Micronutrient Initiative has authorized a Second no-cost extension,** without supplementary funding, for completion of the above-mentioned project currently being undertaken by the Chinese Academy of Preventive Medicine, hereinafter referred as the Recipient.

The new revised completion date of the Project is April 30, 2003 by which time the final technical reports and financial statements on the project are required.

Please note that this extension is being granted for the sole purpose of ensuring adequate allocation of time for the completion of the overall objectives of the project entitled "Impact of Iron Fortification of Soy Sauce on the Micronutrient Status of the Chinese Population: An Efficacy Trial".

We are pleased to continue our collaboration with the Chinese Academy of Preventive Medicine in this important endeavor.

Yours very truly,

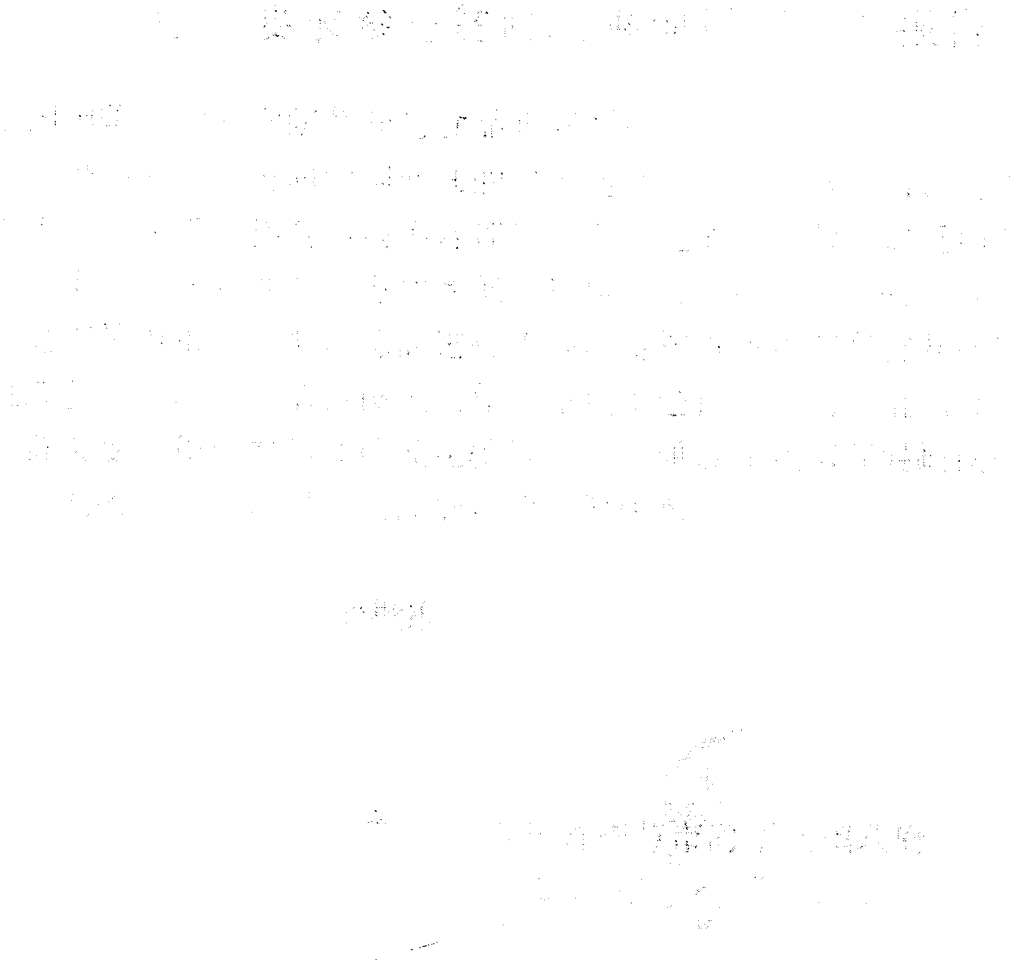
Peter Tully
Vice President
The Micronutrient Initiative

Raymond E. Robinson
Director, Finance and Administration
The Micronutrient Initiative

[illegible]

Appendix 2: Consent documents of Bijie cit

A. Application document from Haizhijie township government to the Health Department of Bijie city.



The Application of Participation in the Anemia Improvement Project

Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine,

Bijie city, Guizhou province is a poor area of western China. Due to the underdevelopment of economy, lack of health knowledge and poor dietary pattern, there are high prevalence of malnutrition diseases. The prevalence of iron deficiency anemia is more than 30% with children, pregnant women and elderly as high risk subpopulations. Therefore, the need for improvement is urgent. We were informed that your Institute is going to carry out an anemia improvement project in Guizhou province and we hope that the project could be conducted in our Town. We will organize the resident to actively participate in the physical examination and blood analysis, in order to improve the health status of our residents.

Government of Hazhijie town, Bijie city, Guizhou province
June 1, 2000

B. Approval document from the Health Department of Bijie city to Haizijie township government

Approval of the Participation of Haizhijie town in the Anemia Improvement Project

After agreed by the Bijie city major, it was approved that your town could participate in the anemia improvement project organized by the Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine. Your responsibility is to organize relevant residents to actively participate in the project.

Health Department of Bijie city
June 6, 2000

Appendix 3: Soy sauce consumption in selected households in Haizijie town, Bijie city

No. of household	No. of person	No. of child <3 year	Soy sauce consumption (ml)	Days of consumption	Per capita intake daily (ml)
1	7	1	3.000	18.0	26.7
2	5	0	2.500	19.5	25.3
3	3	0	1.500	21.5	23.3
4	3	0	1.500	21.0	24.0
5	3	0	1.500	21.5	23.3
6	2	0	1.000	21.5	23.3
7	2	0	1.000	21.0	24.0
8	2	0	1.000	21.0	24.0
9	8	1	3.500	22.0	22.7
10	6	1	2.500	21.5	23.3
11	5	0	2.500	21.5	23.3
12	4	0	2.000	21.0	24.0
13	4	1	1.500	21.5	23.3
14	4	0	2.000	21.0	24.0
15	4	0	2.000	21.0	24.0
16	4	1	1.500	21.0	24.0
17	5	0	2.000	20.0	24.7
18	3	0	1.500	21.0	24.0
19	2	1	1.000	20.0	24.7
20	3	1	1.000	21.0	24.0
21	3	0	1.500	21.5	23.3
22	4	0	2.000	21.0	24.0
23	3	0	1.500	20.0	24.7
24	7	0	3.500	19.5	25.3
25	2	0	1.000	21.0	24.0
26	3	1	1.000	21.0	24.0
27	5	0	2.500	21.0	24.0
28	4	1	1.500	21.5	23.3
29	7	1	3.000	22.0	22.7
30	5	0	2.500	21.5	23.3
31	6	0	3.000	21.0	24.0
32	6	2	2.000	21.0	24.0
33	6	0	3.000	21.0	24.0
34	7	0	3.500	21.0	24.0
35	7	1	3.000	21.0	24.0
36	1	0	500	20.0	24.7
37	3	0	1.500	20.0	24.7

Appendix 4: Methods of blood analysis, anthropometry, mental development, physical endurance and dietary survey

1. Hemoglobin

Method: cyanmethemoglobin method

Instruments and supplies:

1. Model 723 spectrophotometer, Shanghai, China
2. 10 μL capillary: Grummond Scientific Corporation,USA

Reagents:

1. Drabkin's Solution: 140mg KH_2PO_4 + 200mg $K_3Fe(CN)_6$ + 50mg KCN solute in 1000mL distilled water.
2. Cyanmethemoglobin Standard Solution: Hemoglobin Standard, Sigma 525-18 , USA
3. Hemoglobin Control Blood: DiaHT16-1,2,3, DiaMed AG, Switzerland

Method:

1. Intravenous or fingertip blood was taken with a 10μL capillary.
2. Drop the capillary into the test tub with 2.50 ml Drabkin's solution
3. Using Model 723 spectrophotometer to measure the O.D. at 540 nm.
4. Calculate the Hb level

   $Hb = A_{sample} / A_{standard} * C_{standard}$

2. Hematocrit

Instrument and supplies:

1. IEC Micro MB, USA
2. 9 μl capillary: IEC, USA
3. Stop Plaster

Method:

1. Intravenous blood was taken with a 9 μl capillary
2. Centrifuge and read with the value from the IEC Micro MB hematocrit.

3. Ferritin

The RIA method was used.

Instrument:

γ -counter, China

Ferritin RIA Kits, Institute of Atom Energy, Beijng, China

Method:

	Standard curve				Sample
	T count	NSB	S_0	S_{1-6}	
0 standard		0.2	0.1		
Ferritin standard				0.1	
Samples/ control samples					0.1
^{125}I-Anti-Ferritin	0.1	0.1	0.1	0.1	0.1

Mix, keep in 37 °C for 1 hour					
Separate liquid		0.5	0.5	0.5	0.5
Mix, stand at room temperature for 15 minutes					
Centrifuge at 3500rpm for 15 minutes					
Discard the supernatant, take the precipitate to analysis by the γ -counter					

Calculate with a logarithm curve.

4. Protoporphyrin

Materials:

ZP Hematoflurometer, AVIV Biomedical, Lakewood, USA
Cover glass.
Centrifuger
AVIV ZnEP Standard and control samples.
NS: 0.9% NaCl

Method:

1. 0.2 ml anti-coagulate whole blood, centrifuge at 1,000g for 4 min.
2. Discard the plasma, add NS to the RBC layer, mix, centrifuge at 1,000g for 4 min.
3. Discard the NS layer, adding NS to the RBC layer, mix, centrifuge at 1,000g for 4 min.
4. Discard the NS layer
5. Take at least 20 μ l RBC to the cover glass and read the ZP hematoflurometer.

5. Serum VA

The HPLC method was used.
Column: C18 reverse column.
Liquid phase: 98% methanol (HPLC Grade), 2% pure Water (HPLC Grade), 2 ml/min
Detector: UV detector at 325nm.
Retention time: 2.91 min
Method:

1. 100 μ l serum adding 100 μ l ethanol, mixed, adding 0.7 ml hexane, mix for 1 minute, centrifuge at 3,000 rpm for 5 min, a 500 μ l supernatant was taken to a 1.5 ml eppendroff tube, dry at 37 °C under nitrogen, kept under 0 °C until analysis.
2. Dissolve the sample with 200 μ L ethanol, load 50 μ L to the HPLC.
3. Calculation:

   $C_{sample} = \text{Peak area}_{sample} / \text{Peak area}_{standard} * C_{standard}$

Reference:

Guanya Wang, et al, Detecting retinol and Vitamin E in human serum samples with HPLC, Acta Nutrimenta Sinica, 10(3): 272-279

6. Dietary survey

A food frequency questionnaire (Appendix 7) was used and the information was collected by house visit and face-to-face interview.

7. Anthropometry

Height measurement

- Set the standard ruler vertical to the wall.
- Remove shoes. hat and coat.
- Stand straight with eyes forward.
- Measure height to the nearest 0.1 cm.

Weight measurement

- A electronic digital balance was used; with an accuracy of 0.1 kg.
- Check zero kg at every measurement.
- Remove shoes. hat. coat. sweater and etc.; keep under wear.
- Read the weight to the nearest 0.1 kg.

Arm circumference and skin folds (triceps. biceps and abdominal)

- Arm circumference - measure the circumference in the middle of the shoulder and the elbow of the upper arm with a metal ruler to the nearest o.1 cm.
- Skin folds - measure triceps skin fold at 2 cm above the midpoint between the shoulder and the elbow. biceps at 2 cm below the shoulder. and 1 cm left of the naval with a Fat-O-Meter (Novel Product Inc., USA) to the nearest 0.1 cm.

8. Mental development

Clinical Memory Scale (CMS)

The Clinical Memory Scale (CMS) was designed by the Institute of Psychology. China Academy of Science in 1984. The CMS was a standard memory test tool to test the memory ability of child in China. The result could be adjusted by age and education level of the subjects. Norms was made by different age and education groups. totally for about 5600 cases.

The test includes 5 parts, indicate memory. link memory. picture recall, no-meaning curve memory. and human image recall. After the test. scales of each part. and a sum of all the five parts were calculated. The memory quotient (MQ) was calculated by different age and education groups.

Reference:

1. Xiulian Xu. et al. Acta Psychology Sinica. 1984 (in Chinese)

Gessell Developmental Schedule

The Gessell Developmental Schedule was a standard test for the cognitive development of the 0-3.5 year children. It was original published by the Psychological Corporation in 1949.

The schedule include 5 main parts: vocabulary ability. language ability. fine action ability. rough action ability. and social adapt ability.

For each part. the operator will give a scale to the child. and a development quotient (DQ) could be calculated by DQ = scale / accurate age * 100.

An average development quotient will be calculated by the average of all the five parts DQ.

Reference:
Gessell A. et al. 1949. *Vision: Its Development in Infant and Child.*, Landmark Book.
Zhou XJ. et al. The evaluation of the rehabilitation effects on the children with cerebral palsy by Gesell development schedules Chinese Journal of Rehabilitation Medicine. 1999. 14(5):205～207
Zuo QH. et al. The Pathogenic Epidemiology of the 0-14 year Children with Cognitive Disorder all over China. Zhong Hua Yi Xue Za Zhi. 1994.(3)

9. Physical endurance

Materials:

1. A step box. 30cm high
2. A stop watch

Method:

1. Weigh the subject. record in kg (W).
2. Count a 30 seconds pulses record as 'pulses before exercise' (P_1).
3. Get the subject step up and down the step box for 3 minutes at a rhythm of one step per second. use the stop watch to get the accurate exercise time. Record the frequency the subject stepped up the step box (F). and the accurate exercise time (T).
4. Let the subject have a rest for 1 minute and then count the 30 seconds pulses of the subject. Record as 'pulses after exercise' (P_2).
5. Calculate the Step Box Index and Power as below:
   Step Box Index = T / 5.5 / P_2 *100
   Power = W * 0.3 (the height of the step box) * F * T * 4 / 3
6. Evaluations:

Evaluations	Step Box Index
Bad	<50
Middle	50-80
Good	>80

Reference:
Qu. M.. Applied Sports Medicine. Beijing Science and Technology Publishing House. Beijing. 1995. pp.99.

Appendix 5: Height and weight in other age groups than 3-6 year-old

Male					
Group			7-18 yr.	19-54 yr.	55- yr.
	Baseline	Height	139.21±16.54	163.46±6.13	159.88±6.45
			(483)	(481)	(88)
		Weight	33.01±11.63	55.87±6.36	54.46±7.92
Active			(483)	(466)	(88)
	1 year	Height	139.55±16.12*	163.08±5.89	160.82±4.78
			(379)	(306)	(53)
		Weight	33.24±11.15	56.71±6.26	55.08±7.75
			(362)	(310)	(53)
	Baseline	Height	139.56±15.23	163.15±6.06	159.53±6.42
			(471)	(418)	(85)
		Weight	32.82±10.52	56.18±7.40	54.12±7.78
Control			(472)	(420)	(85)
	1 year	Height	141.98±15.6[a]	163.89±5.98	160.09±6.61
			(415)	(292)	(74)
		Weight	34.48±10.76[a]	56.96±7.10	54.82±7.04
			(404)	(297)	(74)

Female						
Group			7-18 yr.	19-30 yr.	31-54 yr.	55- yr.
	Baseline	Height	137.32±13.84	153.36±5.83	151.79±5.38	147.29±5.01
			(398)	(164)	(409)	(97)
		Weight	32.36±10.06*	49.59±6.12	50.26±6.77	47.45±6.81
Active			(395)	(159)	(416)	(100)
	1 year	Height	137.93±14.50	153.13±5.94	152.00±5.54	147.34±5.24
			(324)	(86)	(315)	(64)
		Weight	33.78±11.02	51.15±6.79	51.97±7.27[b]	48.37±7.55
			(311)	(85)	(311)	(63)
	Baseline	Height	135.93±12.79	152.70±5.28	151.50±5.24	147.15±7.21
			(350)	(148)	(412)	(81)
		Weight	30.86±9.55	50.00±6.37	50.47±6.86	47.72±7.58
Control			(352)	(144)	(406)	(83)
	1 year	Height	138.48±13.21[a]	152.69±5.48	151.69±5.22	147.60±5.38
			(324)	(86)	(315)	(64)
		Weight	33.30±10.00[b]	50.96±6.71	51.59±7.36[b]	48.33±7.45
			(329)	(99)	(368)	(70)

Note: Mean±SD: numbers in brackets are number of subjects.
Compare with control group. * $p<0.05$.
Compare with baseline. a $p<0.05$; b $p<0.01$.

Appendix 6: Food frequency questionnaire form

Food Frequency Questionnaire

Date of Interview _____year____month____day

A. Demographic Characteristics

Name_____

Address_____Haizijie town_____ village

1. ID ☐ individual code ☐☐☐☐☐

Student code ☐☐☐☐☐☐☐☐

2. Gender ① male ② female ☐

3. Date of Birth regular calendar ☐☐year☐☐month☐☐day

lunar calendar ☐☐year☐☐month☐☐day

year of animal _____

4. Occupation_____

1 farmers 2. blue collar workers 3. professionals

4. office staff, clerk 5. housework 6. retired 7. others

4. office staff, clerk 5. housework 6. retired 7. others

5. Labor intensity

1. very light 2. light 3. medium 4. heavy 5 very heavy

6. Education _____

1. primary school 2. middle school 3. high school

4. college 5. graduate school 6. illiteracy

7. What is your source of drinking water?

1. tap water 2. well water 3. river or lake water

B. Please estimate your average eating frequency and quantity for the following foods in the past one year

B1 Staple foods	Average intake/time	Frequency					Food code
		Time /day	Time /week	time/ month	time/ year	Never eat	
	Liang	Filling according to the actually consumed				Filling 99	
Rice							01004
Wheat flour							01025
Stick rice							01053
Rice noodle							01004
Millet							01068
Corn							01076
Sorghum							04027

Sweet potato							
Deep fried wheat products							
Other cereals (specify)							

B2 Meats and Prod.	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never eat	
	Liang	Filling according to the actually consumed				Filling 99	
Pork meat (muscle)							12120
Pork meat (fat & muscle)							12110
Pork rib							12100
Pork leg (cooked)							12136
Pork feet (cooked)							12128
Beef meat (fat & muscle)							12047
Mutton meat (fat & muscle)							12075
Pork liver							12104
Pork kidney							12126
Chicken meat							13017
Duck meat							13039
Chicken heart							13027
Chicken stomach							13031
Duck stomach							13052
Goose and other poultry(specify)							13005
Rabbit meat							12062
Dog meat							12021
Other wild animal (specify)							
Sausages							12014
Salted meats							12067
Other sausages with starch							
Other organs (specify)							

B3 Fish and products	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never eat	
	Liang	Filling according to the actually consumed				Filling 99	
Carp							17042
Grass carp							17007
Chub							17039
Crucian							17036
Mud eel							17027
Loach							17050

Hairtail							17012
Big yellow-fin tuna							17011
Small yellow-fin tuna							17061
Conger eel							17023
Butterfish							17008
Shrimp							19009
Dry shrimp							19018
Crab							19020
Octopus							18041
Salted fishes							17068
Shell fish							18028

B4 Milk and products	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
		Filling according to the actually consumed				Filling 99	
Fresh milk (cup)							14018
Whole milk powder (spoon)							14025
Yogurt (cup)							14029
Ice cream (pieces)							22044
Other dairy products (specify)							

B5 Eggs	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Chicken egg							16007
Duck egg							16017
Goose egg							16003
Quail egg							16001
Preserved egg							16016

B6 Legume and products	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Bowl Liang	Filling according to the actually consumed				Filling 99	
Tofu							02009
Tofu paste							02017
Soybean milk							02027

Other soybean products							02056
Fried tofu							02016
Fermented tofu							02031
Dried bean milk in tight rolls							02037
Dry soybean							02044
Other dry bean (specify)							

E7 Salted vegetables	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Salted mustard							08005
Salted radish							08023
Salted cucumber							08012
Preserved Sichuan pickle							08035
Salted mustard							08034
B8 fungi and mushroom	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Fresh mushroom							09016
Dried mushroom							09015
Kelp							09006

B9 fresh vegetables	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Vegetables total							

Name of vegetables consumed and % accounted of total intake

Code	Name of vegetable	Frequency (times/year)	% of total intake	Food code
1	Chinese cabbage			05014
2	Fermented cabbage			05015
3	Spinach			05004

4	Celery			05050
5	Garlic			05058
6	Cole			05073
7	Squash			06022
8	Balsam pear			06017
9	Cucumber			06009
10	Towel gourd			06024
11	Chinese watermelon			06005
12	Hollow vegetables			05061
13	Egg plant			07001
14	Green capsicum			07009
15	Tomato			07003
16	Haricot bean			03001
17	Green soybean			03015
18	Green kidney bean			03016
19	Soybean sprout			03008
20	Green bean sprout			03011
21	Pea sprout			03018
22	Bamboo shoot			04044
23				
24				
25				
26				
27				
28				
29				
30				

B10 Fruits	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Banana							10001
Watermelon							06030
Chinese gooseberry							10155
Apple							10075
Pear							10037
Orange							10029
Grape							10092
Peach							10112
Chinese date							10146
Megranate							10009
Strawberry							10005
Apricot							10131

Plum							10132
Longan							10013
Lichee							10064
Pineapple							10002
Persimmon							10103
Hawkthorn							10021
Canned fruit							10089
Dried grape							10098
Preserved fruits (specify)							

B11-B12 The following questions be asked by family by month. How many persons are there eating together in the family ____ ?

B11 Edible oil	Food code	Intake (Jin/month/family)	Intake/person/day* (gram/day)
Peanut oil	20005		
Soy bean oil	20004		
Grape seed oil	20001		
Mixed vegetable oil	20013		
Other vegetable oils (specify)			
Pork fat	20020		
Other animal oil (specify)			

B12 Spices	Food code	Intake (Jin/month/family)	Intake/person/day* (gram/day)
Salt	26046		
Soy sauce	26019		
Vinegar	26002		
Tomato paste	26033		
Sesame paste	26046		
MSG	26044		
Capsicum paste	26040		

B13 Tea	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time /month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	
Green tea							22011
Black tea							22008
Jasmine tea							22009
Bitter tea							
Other tea (specify)							

B14 Other food frequently consumed	Average intake/time	Frequency					Food code
		Time /day	Time /week	Time month	Time /year	Never Eat	
	Liang	Filling according to the actually consumed				Filling 99	

Inquirer: _____ verifier: _____

Appendix 7:

Food consumption in 3-6 year-old children (g/person/day)

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Baseline						
Rice/Prod.	87	149.18	111.31	54	184.34	123.93
Wheat/Prod.	87	36.30	30.16	54	46.76	50.93
Other Cereals	87	124.19	109.29	54	136.18	145.29
Starch Tubers	87	96.00	103.85	54	75.64	72.04
Legume prod.	87	48.83	117.18	54	42.05	48.00
Fresh fruit	87	29.59	32.31	54	38.69	41.11
Animal meat	87	30.06	51.03	54	36.56	51.60
Animal viscera	87	1.96	3.80	54	2.62	4.25
Paultry	87	1.58	1.39	54	2.29	4.67
Milk/Prod.	87	0.92	3.59	54	0.20	1.18
Eggs/Prod.	87	9.36	16.33	54	9.92	19.38
Fish/Shellfish	87	0.30	1.11	54	1.07	3.22
Vegetables	87	435.76	208.96	54	437.78	262.89
Vegetable oil	87	9.29	10.46	54	6.79	8.52
Animal fat	87	20.85	12.55	54	16.59	7.99
Salt	87	9.58	4.53	54	11.61	6.78
Vinegar	87	4.88	6.87	54	4.29	5.91
Soy sauce	87	12.96	7.56	54	13.39	6.89
6 mos.						
Rice/Prod.	41	117.41	88.37	23	102.91	79.17
Wheat/Prod.	41	43.35	40.28	23	23.25	25.37
Other Cereals	41	213.26	146.39	23	267.45	125.65
Starch Tubers	41	47.60	35.01	23	54.86	59.63
Legume prod.	41	39.27	25.25	23	26.61	23.69
Fresh fruit	41	13.58	9.43	23	10.01	11.63
Animal meat	41	33.63	18.47	23	34.61	20.24
Animal viscera	41	2.19	3.52	23	2.45	1.49
Paultry	41	0.73	1.19	23	0.29	0.42
Milk/Prod.	41	0.21	1.33	23	0.00	0.00
Eggs/Prod.	41	5.22	3.47	23	4.18	2.21
Fish/Shellfish	41	0.00	0.00	23	0.00	0.00
Vegetables	41	431.22	128.75	23	460.99	137.31
Vegetable oil	41	5.59	3.57	23	5.39	3.46
Animal fat	41	16.81	4.52	23	12.60	4.58
Salt	41	5.09	1.80	23	4.93	1.97
Vinegar	41	2.39	2.00	23	1.41	2.03
Soy sauce	41	16.37	1.69	23	15.64	3.75

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
12 mos.						
Rice/Prod.	50	121.78	106.34	39	109.72	100.81
Wheat/Prod.	50	19.83	28.00	39	15.10	24.82
Other Cereals	50	174.80	122.92	39	193.42	131.35
Starch Tubers	50	119.75	64.14	39	123.74	138.25
Legume prod.	50	25.02	28.87	39	19.49	20.48
Fresh fruit	50	23.92	45.06	39	18.64	23.29
Animal meat	50	7.73	16.22	39	4.07	5.75
Animal viscera	50	0.58	2.16	39	0.41	0.04
Paultry	50	0.10	0.27	39	0.15	0.55
Milk/Prod.	50	0.10	0.70	39	0.02	0.11
Eggs/Prod.	50	1.93	4.56	39	1.86	2.57
Fish/Shellfish	50	0.00	0.02	39	0.00	0.00
Vegetables	50	397.73	101.13	39	401.57	122.22
Vegetable oil	50	4.25	4.61	39	4.35	4.49
Animal fat	50	16.90	9.55	39	11.80	4.88
Salt	50	6.14	1.92	39	6.31	2.09
Vinegar	50	3.00	3.42	39	2.69	2.68
Soy sauce	50	15.51	3.30	39	15.97	2.28
18 mos.						
Rice/Prod.	26	128.70	74.79	19	131.16	84.94
Wheat/Prod.	26	19.52	13.58	19	12.73	14.65
Other Cereals	26	180.77	93.89	19	188.16	107.49
Starch Tubers	26	40.87	23.74	19	65.29	83.05
Legume prod.	26	25.56	14.44	19	25.98	10.02
Fresh fruit	26	19.28	18.70	19	14.79	11.14
Animal meat	26	19.49	12.49	19	14.55	7.98
Animal viscera	26	0.09	0.16	19	0.17	0.42
Paultry	26	0.24	0.27	19	0.22	0.33
Milk/Prod.	26	0.00	0.00	19	0.00	0.00
Eggs/Prod.	26	2.49	2.08	19	2.44	2.12
Fish/Shellfish	26	0.00	0.00	19	0.00	0.00
Vegetables	26	410.90	120.49	19	466.31	113.78
Vegetable oil	26	3.56	2.34	19	1.66	2.40
Animal fat	26	15.66	4.44	19	14.98	2.52
Salt	26	4.36	1.80	19	3.68	1.83
Vinegar	26	2.33	2.25	19	1.45	1.61
Soy sauce	26	16.51	3.91	19	15.83	1.34

Food consumption in 7-18 year-old group (g/person/day)

Baseline

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	178	230.53	167.29	159	187.12	163.53
Wheat/Prod.	178	49.04	52.20	158	39.80	44.09
Other Cereals	178	180.06	153.42	158	248.58	177.04
Starch Tubers	178	140.14	137.95	158	153.68	171.34
Legume prod.	178	52.91	97.77	158	35.73	38.17
Fresh fruit	178	44.61	65.60	158	34.64	46.16
Animal meat	178	27.09	46.25	158	28.43	32.23
Animal viscera	178	3.68	4.94	158	2.60	7.18
Paultry	178	1.43	4.32	158	1.58	1.06
Milk/Prod.	178	0.00	0.00	158	0.03	0.22
Eggs/Prod.	178	8.56	30.22	158	7.32	12.93
Fish/Shellfish	178	0.75	1.86	158	0.52	2.18
Vegetables	178	575.67	248.83	158	516.44	294.26
Vegetable oil	178	7.49	6.75	158	7.31	6.85
Animal fat	178	20.37	12.14	158	15.07	8.70
Salt	178	9.45	4.67	158	10.78	5.95
Vinegar	178	3.77	5.17	158	4.79	6.43
Soy sauce	178	12.96	7.06	158	11.54	6.74
Female						
Rice/Prod.	169	209.63	163.45	127	179.49	136.53
Wheat/Prod.	169	54.05	48.55	127	40.50	39.26
Other Cereals	169	189.32	139.07	127	223.06	155.68
Starch Tubers	169	116.50	116.03	127	132.55	138.58
Legume prod.	169	53.22	82.23	127	43.39	42.34
Fresh fruit	169	46.62	52.60	127	45.65	54.07
Animal meat	169	29.44	39.41	127	30.31	34.83
Animal viscera	169	3.23	5.36	127	3.00	5.22
Paultry	169	1.30	4.34	127	0.84	1.76
Milk/Prod.	169	0.04	0.51	127	0.09	0.51
Eggs/Prod.	169	7.44	9.96	127	10.29	22.31
Fish/Shellfish	169	0.48	1.41	127	0.84	3.95
Vegetables	169	491.52	217.98	127	498.33	312.70
Vegetable oil	169	7.31	5.79	126	7.85	10.25
Animal fat	169	20.08	13.08	126	17.13	11.52
Salt	169	8.84	5.38	126	10.17	6.63
Vinegar	169	4.35	6.05	126	5.20	5.04
Soy sauce	169	12.34	8.04	126	13.05	7.96

6 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	58	188.61	136.84	59	173.37	101.27
Wheat/Prod.	58	48.51	48.28	60	29.50	27.85
Other Cereals	58	249.30	180.33	60	341.28	189.85
Starch Tubers	58	68.29	63.30	60	63.06	49.37
Legume prod.	58	47.69	33.43	60	37.54	28.28
Fresh fruit	58	21.68	27.31	60	17.78	8.69
Animal meat	58	70.13	54.97	60	63.23	23.02
Animal viscera	58	1.37	2.43	60	0.35	1.26
Paultry	58	0.70	1.14	60	0.45	0.52
Milk/Prod.	58	0.15	1.12	60	0.00	0.00
Eggs/Prod.	58	3.85	17.87	60	2.99	3.12
Fish/Shellfish	58	0.04	0.14	60	0.00	0.00
Vegetables	58	544.58	131.37	60	540.11	136.02
Vegetable oil	58	4.15	3.74	60	2.21	3.28
Animal fat	58	17.06	5.27	60	14.64	4.00
Salt	58	5.71	2.00	60	4.92	1.96
Vinegar	58	2.66	2.52	60	1.48	2.04
Soy sauce	58	17.32	1.93	60	15.18	2.76
Female						
Rice/Prod.	80	193.33	124.34	58	155.46	122.19
Wheat/Prod.	80	39.76	37.64	56	21.03	20.77
Other Cereals	80	241.93	178.23	56	281.46	174.31
Starch Tubers	80	54.46	59.17	56	68.01	58.08
Legume prod.	80	40.38	30.55	56	32.09	24.10
Fresh fruit	80	18.02	16.17	56	5.59	6.00
Animal meat	80	40.03	54.89	56	37.38	18.93
Animal viscera	80	1.51	4.91	56	0.14	0.34
Paultry	80	0.41	0.70	56	0.33	0.39
Milk/Prod.	80	0.00	0.00	56	0.01	0.09
Eggs/Prod.	80	6.61	6.92	56	5.93	3.11
Fish/Shellfish	80	0.01	0.04	56	0.00	0.00
Vegetables	80	520.75	141.61	56	534.24	123.19
Vegetable oil	80	4.32	4.37	56	2.30	2.86
Animal fat	80	16.69	4.70	56	13.56	4.16
Salt	80	5.10	1.97	56	5.02	1.95
Vinegar	80	2.47	2.14	56	2.26	2.44
Soy sauce	80	17.22	2.51	56	15.23	2.60

12 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	209	147.76	136.85	238	152.40	137.71
Wheat/Prod.	209	33.70	42.16	238	22.81	34.39
Other Cereals	209	282.64	175.80	238	287.14	191.68
Starch Tubers	209	164.88	110.37	238	187.81	125.79
Legume prod.	209	49.62	59.20	238	35.41	35.62
Fresh fruit	209	62.48	101.64	238	29.13	58.65
Animal meat	209	1.68	8.34	238	0.15	0.66
Animal viscera	209	0.35	1.03	238	0.21	0.58
Paultry	209	0.08	1.14	238	0.03	0.28
Milk/Prod.	209	8.66	22.05	238	3.65	10.12
Eggs/Prod.	209	0.09	0.51	238	0.02	0.10
Fish/Shellfish	209	2.64	6.73	238	0.85	2.71
Vegetables	209	516.63	131.01	238	527.10	121.15
Vegetable oil	209	5.49	4.80	238	4.98	4.78
Animal fat	209	16.89	7.88	238	12.00	5.60
Salt	209	7.30	2.58	238	6.67	1.85
Vinegar	209	2.99	2.96	238	2.12	2.64
Soy sauce	209	16.61	3.66	238	15.93	2.12
Female						
Rice/Prod.	206	157.97	149.91	197	134.80	125.63
Wheat/Prod.	205	29.20	35.17	197	20.03	29.61
Other Cereals	205	261.67	185.19	197	274.43	169.10
Starch Tubers	205	156.42	96.42	197	177.23	119.61
Legume prod.	205	40.16	47.19	197	30.38	32.12
Fresh fruit	205	30.07	22.02	197	21.46	18.14
Animal meat	205	5.91	8.76	197	5.52	7.93
Animal viscera	205	0.58	2.46	197	0.29	1.94
Paultry	205	0.64	2.22	197	0.15	0.56
Milk/Prod.	205	0.03	0.22	197	0.01	0.20
Eggs/Prod.	205	3.61	5.11	197	2.46	3.74
Fish/Shellfish	205	0.06	0.40	197	0.01	0.06
Vegetables	205	483.99	127.46	197	509.47	122.78
Vegetable oil	205	4.90	5.02	197	4.13	4.30
Animal fat	205	17.19	9.32	197	12.36	5.05
Salt	205	7.44	2.58	197	6.47	1.85
Vinegar	205	2.92	2.77	197	1.83	2.36
Soy sauce	205	16.17	3.49	197	15.79	1.95

18 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	19	242.65	108.09	60	213.32	124.05
Wheat/Prod.	19	24.25	18.41	59	24.63	22.07
Other Cereals	19	276.32	119.45	59	274.80	157.28
Starch Tubers	19	46.84	36.48	59	55.01	60.34
Legume prod.	19	28.64	27.43	59	34.82	17.24
Fresh fruit	19	17.30	10.53	59	18.83	10.19
Animal meat	19	25.47	17.66	59	25.48	24.20
Animal viscera	19	0.16	0.40	59	0.30	1.33
Paultry	19	0.29	0.76	59	0.39	0.43
Milk/Prod.	19	0.00	0.00	59	0.00	0.00
Eggs/Prod.	19	2.42	1.63	59	3.98	3.72
Fish/Shellfish	19	0.00	0.00	59	0.00	0.00
Vegetables	19	565.07	112.15	59	599.85	145.70
Vegetable oil	19	2.58	2.03	59	2.15	2.42
Animal fat	19	16.24	2.46	58	14.60	4.28
Salt	19	5.21	2.15	59	3.60	1.04
Vinegar	19	2.32	1.85	59	1.87	1.77
Soy sauce	19	15.97	3.12	59	16.16	2.41
Female						
Rice/Prod.	20	169.64	98.93	43	180.35	107.71
Wheat/Prod.	20	27.95	23.99	43	28.11	26.83
Other Cereals	20	266.77	141.69	43	272.11	128.74
Starch Tubers	20	42.44	33.85	43	49.79	25.91
Legume prod.	20	28.58	22.34	43	37.27	18.90
Fresh fruit	20	21.49	19.49	43	16.11	9.50
Animal meat	20	32.05	24.54	43	30.21	13.06
Animal viscera	20	0.27	0.43	43	0.07	0.21
Paultry	20	0.16	0.34	43	0.24	0.31
Milk/Prod.	20	0.00	0.00	43	0.00	0.00
Eggs/Prod.	20	2.78	3.07	43	3.68	3.21
Fish/Shellfish	20	0.01	0.06	43	0.00	0.00
Vegetables	20	582.82	163.19	43	606.18	147.07
Vegetable oil	20	3.16	2.88	43	1.49	2.06
Animal fat	20	15.47	3.02	43	14.69	4.50
Salt	20	4.61	1.95	43	3.30	0.83
Vinegar	20	1.89	1.81	43	1.05	1.55
Soy sauce	20	15.52	1.69	43	15.13	3.47

Food consumption in 19-54 year-old group (g/person/day)

Baseline

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	254	307.56	189.82	238	296.91	185.64
Wheat/Prod.	254	65.05	68.81	238	67.11	69.84
Other Cereals	254	240.05	205.73	238	251.79	212.24
Starch Tubers	254	149.15	150.82	238	126.15	139.84
Legume prod.	254	74.85	85.99	238	72.14	74.84
Fresh fruit	254	57.97	71.85	238	58.48	66.46
Animal meat	254	63.44	79.08	238	68.89	97.52
Animal viscera	254	5.17	7.60	238	5.28	9.87
Paultry	254	2.16	4.29	238	2.87	8.79
Milk/Prod.	254	0.06	0.46	238	0.90	5.89
Eggs/Prod.	254	16.02	32.66	238	16.53	35.41
Fish/Shellfish	254	1.91	4.15	238	2.41	5.83
Vegetables	254	807.78	1188.41	238	754.59	1359.28
Vegetable oil	254	9.39	11.51	238	9.33	10.13
Animal fat	253	21.50	13.66	238	19.57	12.10
Salt	254	10.13	5.76	238	10.87	5.49
Vinegar	253	5.49	6.86	238	7.62	9.42
Soy sauce	254	15.54	9.11	238	15.04	8.90
Female (19-30 yr.)						
Rice/Prod.	85	320.49	185.18	85	273.64	153.22
Wheat/Prod.	85	50.43	43.46	85	54.41	55.76
Other Cereals	85	186.54	175.78	85	209.29	176.80
Starch Tubers	85	169.47	176.18	85	118.61	130.69
Legume prod.	85	75.04	123.86	85	59.81	67.32
Fresh fruit	85	58.46	57.90	85	63.48	81.48
Animal meat	85	60.95	75.70	85	55.48	71.60
Animal viscera	85	5.72	9.06	85	5.26	9.38
Paultry	85	1.67	3.23	85	2.56	7.12
Milk/Prod.	85	0.64	4.69	85	1.72	10.21
Eggs/Prod.	85	14.67	20.18	85	12.54	17.38
Fish/Shellfish	85	1.89	3.70	85	2.55	10.04
Vegetables	85	630.24	322.04	85	637.99	259.03
Vegetable oil	85	8.86	7.55	85	11.01	12.18
Animal fat	85	24.67	14.91	85	20.73	13.19
Salt	85	9.73	5.61	85	11.10	6.24
Vinegar	85	4.91	5.40	85	7.10	7.17
Soy sauce	85	14.14	6.80	85	15.77	11.11

Female (31-54 yr.)						
Rice/Prod.	215	254.82	166.26	248	266.52	165.55
Wheat/Prod.	215	58.29	58.02	249	52.91	53.41
Other Cereals	215	244.91	171.17	249	224.32	182.82
Starch Tubers	215	128.71	115.90	249	127.82	149.37
Legume prod.	215	56.85	77.91	249	56.94	67.59
Fresh fruit	215	45.49	56.98	249	45.28	57.48
Animal meat	215	49.28	70.61	249	47.21	80.29
Animal viscera	215	3.35	4.95	249	4.85	11.84
Paultry	215	1.39	3.43	249	1.58	4.40
Milk/Prod.	215	0.10	1.36	249	0.12	10.27
Eggs/Prod.	215	11.79	17.04	249	12.26	31.14
Fish/Shellfish	215	0.94	2.16	249	0.94	2.19
Vegetables	215	747.00	2807.99	249	750.21	2142.67
Vegetable oil	215	8.56	9.75	249	8.67	8.71
Animal fat	215	20.17	12.97	249	18.62	12.46
Salt	215	10.05	5.67	249	10.54	5.82
Vinegar	215	5.45	7.55	249	6.41	7.31
Soy sauce	215	14.72	8.72	249	14.32	9.26

6 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	81	281.44	185.07	78	232.23	136.98
Wheat/Prod.	81	35.10	34.84	78	28.49	26.80
Other Cereals	81	318.25	191.35	78	355.25	180.77
Starch Tubers	81	46.42	47.98	78	47.41	41.65
Legume prod.	81	45.33	30.33	78	39.19	27.42
Fresh fruit	81	19.59	16.21	78	11.84	11.12
Animal meat	81	79.89	58.99	78	72.65	32.22
Animal viscera	81	2.16	4.80	78	0.93	1.89
Paultry	81	0.64	0.94	78	0.37	0.58
Milk/Prod.	81	0.00	0.00	78	0.00	0.00
Eggs/Prod.	81	7.32	8.21	78	6.29	4.91
Fish/Shellfish	81	0.12	0.32	78	0.08	0.30
Vegetables	81	622.90	137.78	78	656.90	124.78
Vegetable oil	81	3.92	4.59	78	2.43	3.01
Animal fat	81	17.93	5.29	78	15.51	3.70
Salt	81	5.71	1.67	78	4.87	1.76
Vinegar	81	2.85	2.47	78	1.97	2.37
Soy sauce	81	17.33	2.72	78	15.81	3.25

Female (19-30 yr.)						
Rice/Prod.	35	237.87	156.27	32	216.90	138.55
Wheat/Prod.	35	51.50	42.36	32	30.65	29.66
Other Cereals	35	328.97	167.49	32	362.60	169.22
Starch Tubers	35	60.92	52.91	32	48.34	50.82
Legume prod.	35	44.22	25.64	32	33.55	26.60
Fresh fruit	35	14.07	12.20	32	12.09	9.18
Animal meat	35	48.14	31.88	32	37.96	18.57
Animal viscera	35	1.75	3.71	32	1.33	1.28
Paultry	35	0.94	1.38	32	0.20	0.41
Milk/Prod.	35	0.00	0.00	32	0.00	0.00
Eggs/Prod.	35	6.27	5.77	32	6.06	3.22
Fish/Shellfish	35	0.04	0.21	32	0.02	0.10
Vegetables	35	659.27	105.65	32	653.80	131.43
Vegetable oil	35	4.90	3.69	32	2.25	3.23
Animal fat	35	16.69	5.59	32	13.96	3.24
Salt	35	5.16	2.01	32	4.53	1.85
Vinegar	35	2.97	2.23	32	2.69	2.29
Soy sauce	35	16.52	1.89	32	15.96	2.53
Female (31-54 yr.)						
Rice/Prod.	84	238.44	145.22	86	214.97	130.60
Wheat/Prod.	84	38.23	37.19	86	25.82	23.73
Other Cereals	84	296.77	170.40	86	354.71	171.13
Starch Tubers	84	53.19	51.95	86	57.25	58.62
Legume prod.	84	42.52	28.22	86	38.52	26.63
Fresh fruit	84	15.20	15.09	86	10.26	10.17
Animal meat	84	56.27	37.13	86	45.07	30.08
Animal viscera	84	1.66	4.17	86	1.56	1.36
Paultry	84	0.61	1.04	86	0.47	0.55
Milk/Prod.	84	0.01	0.07	86	0.00	0.00
Eggs/Prod.	84	6.05	6.95	86	6.24	4.57
Fish/Shellfish	84	0.02	0.09	86	0.02	0.12
Vegetables	84	587.71	134.47	86	639.17	132.17
Vegetable oil	84	4.31	4.57	86	2.21	2.94
Animal fat	84	17.18	4.79	86	15.30	4.16
Salt	84	5.67	1.97	86	4.64	1.67
Vinegar	84	2.56	2.69	86	1.44	2.14
Soy sauce	84	17.30	2.07	86	15.91	3.16

12 mos.						
Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	163	235.31	187.47	164	242.68	214.76
Wheat/Prod.	164	37.45	45.62	163	20.78	33.93
Other Cereals	164	358.69	255.42	163	358.25	240.63
Starch Tubers	164	187.05	132.58	163	199.07	146.99
Legume prod.	164	67.09	87.16	163	47.36	49.18
Fresh fruit	164	64.66	64.26	163	46.48	97.17
Animal meat	164	18.91	37.41	163	13.28	29.89
Animal viscera	164	1.03	2.89	163	0.31	0.89
Paultry	164	0.68	2.10	163	0.62	2.67
Milk/Prod.	164	0.05	0.64	163	0.00	0.00
Eggs/Prod.	164	8.67	22.74	163	3.36	6.13
Fish/Shellfish	164	0.36	1.13	163	0.22	0.93
Vegetables	164	680.85	147.27	163	697.45	122.76
Vegetable oil	164	5.28	4.73	163	5.20	5.55
Animal fat	164	17.26	8.36	163	13.41	6.44
Salt	164	7.15	2.50	163	7.18	2.60
Vinegar	164	3.23	3.09	163	2.05	2.64
Soy sauce	164	16.59	3.95	163	16.40	2.65
Female (19-30 yr.)						
Rice/Prod.	38	210.96	157.56	38	252.05	208.02
Wheat/Prod.	38	45.93	50.22	39	26.95	46.65
Other Cereals	38	292.14	183.76	39	313.69	221.05
Starch Tubers	38	149.12	94.85	39	177.76	117.04
Legume prod.	38	65.32	66.56	39	46.77	46.87
Fresh fruit	38	50.63	51.31	39	47.80	67.36
Animal meat	38	15.50	28.98	39	12.20	18.50
Animal viscera	38	1.40	5.24	39	1.32	1.08
Paultry	38	1.99	5.61	39	1.45	1.60
Milk/Prod.	38	0.00	0.00	39	0.00	0.00
Eggs/Prod.	38	5.12	5.90	39	4.17	8.57
Fish/Shellfish	38	0.41	1.34	39	0.44	2.02
Vegetables	38	609.11	117.87	39	662.48	197.06
Vegetable oil	38	4.81	4.04	39	6.76	6.65
Animal fat	38	19.03	7.86	39	15.05	7.20
Salt	38	7.13	2.90	39	6.88	2.62
Vinegar	38	3.46	2.96	39	2.10	2.73
Soy sauce	38	15.80	3.44	39	16.52	3.92

Female (31-54 yr.)						
Rice/Prod.	172	206.67	167.93	221	190.14	173.64
Wheat/Prod.	172	32.10	37.15	221	19.69	29.46
Other Cereals	172	342.79	213.85	221	370.97	225.14
Starch Tubers	172	189.00	122.82	221	213.53	150.34
Legume prod.	172	58.32	85.23	221	39.53	42.21
Fresh fruit	172	39.96	45.77	221	33.80	66.22
Animal meat	172	8.03	28.25	221	9.18	21.68
Animal viscera	172	1.77	6.10	221	0.34	1.43
Paultry	172	0.96	5.25	221	0.32	1.55
Milk/Prod.	172	0.05	0.32	221	0.00	0.00
Eggs/Prod.	172	4.22	6.14	221	3.56	4.56
Fish/Shellfish	172	0.28	1.71	221	0.06	0.46
Vegetables	172	644.79	130.13	221	656.74	115.68
Vegetable oil	172	5.76	5.09	221	4.42	4.81
Animal fat	172	17.64	8.51	221	12.39	5.83
Salt	172	7.59	2.83	221	6.74	2.04
Vinegar	172	3.24	3.05	221	1.78	2.49
Soy sauce	172	17.19	4.37	221	15.85	2.42
18 mos.						
Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	39	262.16	133.25	77	225.24	116.39
Wheat/Prod.	39	23.39	18.38	77	23.06	28.09
Other Cereals	39	326.37	117.16	77	355.97	176.89
Starch Tubers	39	48.72	26.47	77	58.32	34.76
Legume prod.	39	40.39	20.98	77	45.38	29.37
Fresh fruit	39	19.47	9.18	76	20.22	13.06
Animal meat	39	37.83	25.77	77	29.67	36.29
Animal viscera	39	0.48	1.00	77	0.54	1.86
Paultry	39	0.42	0.86	77	0.38	0.70
Milk/Prod.	39	0.00	0.00	77	0.00	0.00
Eggs/Prod.	39	3.04	3.16	77	3.35	4.85
Fish/Shellfish	39	0.04	0.16	77	0.09	0.41
Vegetables	39	653.47	175.78	77	724.62	224.44
Vegetable oil	39	2.56	3.48	77	1.45	2.15
Animal fat	39	15.27	3.97	77	15.44	4.10
Salt	39	4.25	1.65	77	3.32	1.15
Vinegar	39	2.05	2.04	77	0.95	1.61
Soy sauce	39	16.30	1.10	77	16.04	4.00

Female (19-30 yr.)						
Rice/Prod.	20	223.69	128.90	18	216.88	123.35
Wheat/Prod.	20	26.05	18.23	18	19.54	18.89
Other Cereals	20	332.50	152.41	18	325.00	112.79
Starch Tubers	20	42.03	24.51	18	49.22	24.94
Legume prod.	20	40.33	14.42	18	38.21	18.38
Fresh fruit	20	20.14	10.31	18	17.02	8.36
Animal meat	20	32.90	17.77	18	33.63	19.84
Animal viscera	20	0.23	0.35	18	0.15	0.33
Paultry	20	0.29	0.34	18	0.27	0.38
Milk/Prod.	20	0.00	0.00	18	0.00	0.00
Eggs/Prod.	20	2.98	2.09	18	2.01	2.20
Fish/Shellfish	20	0.01	0.06	18	0.00	0.00
Vegetables	20	631.58	152.55	18	705.65	115.61
Vegetable oil	20	2.31	2.59	18	1.41	1.87
Animal fat	20	15.43	3.28	18	14.22	4.29
Salt	20	3.95	1.43	18	3.42	1.46
Vinegar	20	2.91	1.58	18	1.60	1.89
Soy sauce	20	15.57	2.10	18	15.66	5.27
Female (31-54 yr.)						
Rice/Prod.	45	251.62	141.27	107	222.19	123.73
Wheat/Prod.	45	27.26	21.52	108	20.38	19.32
Other Cereals	45	307.32	145.06	108	317.59	166.09
Starch Tubers	45	47.39	27.94	108	54.87	28.83
Legume prod.	45	34.49	18.84	108	38.53	17.68
Fresh fruit	45	20.47	13.81	108	17.82	10.78
Animal meat	45	32.38	23.57	108	27.23	27.67
Animal viscera	45	0.30	0.62	108	0.37	1.16
Paultry	45	0.28	0.43	108	0.37	0.43
Milk/Prod.	45	0.00	0.00	108	0.00	0.00
Eggs/Prod.	45	3.33	2.79	108	3.25	3.04
Fish/Shellfish	45	0.00	0.00	108	0.01	0.06
Vegetables	45	651.73	128.33	108	687.08	110.94
Vegetable oil	45	2.75	3.34	108	1.79	2.61
Animal fat	44	14.39	3.37	108	15.06	3.28
Salt	45	4.46	2.34	108	3.47	1.20
Vinegar	45	1.65	1.79	108	1.38	1.82
Soy sauce	45	15.87	1.57	108	15.78	2.43

Food consumption in ≥55 year-old group (g/person/day)

Baseline

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	51	302.02	139.47	52	295.81	177.09
Wheat/Prod.	51	58.00	60.21	52	50.17	55.30
Other Cereals	51	221.88	188.07	52	190.71	172.80
Starch Tubers	51	100.13	92.56	52	86.45	98.87
Legume prod.	51	52.32	42.58	52	48.70	44.50
Fresh fruit	51	38.71	69.21	52	38.42	46.78
Animal meat	51	54.99	63.92	52	49.06	58.59
Animal viscera	51	4.36	8.18	52	1.43	2.14
Paultry	51	1.25	3.07	52	0.69	1.21
Milk/Prod.	51	0.00	0.00	52	0.00	0.00
Eggs/Prod.	51	12.09	14.84	52	11.70	21.36
Fish/Shellfish	51	1.51	4.64	52	0.96	1.67
Vegetables	51	667.70	271.76	52	689.19	864.20
Vegetable oil	51	9.58	8.16	52	9.40	12.20
Animal fat	51	17.21	15.96	52	19.34	14.81
Salt	51	10.12	6.21	52	13.17	6.05
Vinegar	51	7.33	7.80	52	9.99	8.95
Soy sauce	51	17.33	10.63	52	17.18	11.22
Female						
Rice/Prod.	47	282.78	147.41	48	290.95	154.70
Wheat/Prod.	47	53.29	46.70	48	38.32	42.67
Other Cereals	47	186.34	182.69	48	177.70	165.45
Starch Tubers	47	95.01	85.92	48	69.10	66.11
Legume prod.	47	59.90	84.02	48	39.37	34.98
Fresh fruit	47	26.25	116.72	48	20.05	20.07
Animal meat	47	52.11	62.54	48	58.35	31.40
Animal viscera	47	4.57	9.69	48	4.13	4.07
Paultry	47	0.70	1.96	48	0.78	1.66
Milk/Prod.	47	0.92	5.84	48	0.00	0.00
Eggs/Prod.	47	7.15	16.45	48	6.67	12.35
Fish/Shellfish	47	1.10	3.02	48	0.64	1.16
Vegetables	47	501.60	310.89	48	506.90	249.00
Vegetable oil	47	9.55	9.63	48	10.18	12.32
Animal fat	47	24.47	14.33	48	19.70	13.88
Salt	47	11.55	6.13	48	13.05	7.30
Vinegar	47	6.91	7.27	48	7.86	8.41
Soy sauce	47	16.64	9.80	48	14.63	9.63

6 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	20	295.71	177.20	13	221.48	142.47
Wheat/Prod.	20	33.81	25.78	14	22.39	34.26
Other Cereals	20	237.50	161.31	14	285.91	180.93
Starch Tubers	20	37.49	59.50	14	63.05	62.71
Legume prod.	20	38.14	30.07	14	40.33	31.69
Fresh fruit	20	16.60	21.55	14	10.40	10.96
Animal meat	20	55.08	20.38	14	44.57	28.41
Animal viscera	20	1.35	3.12	14	1.52	0.61
Paultry	20	1.16	1.51	14	1.35	0.57
Milk/Prod.	20	0.00	0.00	14	0.00	0.00
Eggs/Prod.	20	4.32	4.59	14	6.31	8.62
Fish/Shellfish	20	0.00	0.00	14	0.02	0.07
Vegetables	20	552.19	128.46	14	605.65	132.55
Vegetable oil	20	2.96	4.82	14	3.83	3.77
Animal fat	20	16.34	3.98	14	14.21	4.84
Salt	20	6.00	3.30	14	4.77	1.84
Vinegar	20	1.18	2.12	14	0.94	1.59
Soy sauce	20	16.70	1.80	14	16.31	3.03
Female						
Rice/Prod.	18	306.63	182.83	20	252.39	121.62
Wheat/Prod.	18	31.78	29.42	20	24.90	31.55
Other Cereals	18	219.44	148.66	20	235.31	119.79
Starch Tubers	18	29.22	32.27	20	39.38	67.12
Legume prod.	18	35.65	26.41	20	27.13	25.69
Fresh fruit	18	16.97	20.53	20	15.55	10.56
Animal meat	18	54.64	22.01	20	55.25	24.24
Animal viscera	18	0.41	1.20	20	0.85	2.02
Paultry	18	0.90	0.95	20	0.29	0.61
Milk/Prod.	18	0.00	0.00	20	0.00	0.00
Eggs/Prod.	18	3.90	4.60	20	5.48	7.46
Fish/Shellfish	18	0.00	0.00	20	0.00	0.00
Vegetables	18	583.92	126.28	20	554.63	125.35
Vegetable oil	18	2.99	3.79	20	1.56	2.62
Animal fat	18	15.88	2.91	20	15.73	4.64
Salt	18	5.12	1.53	20	4.88	1.48
Vinegar	18	1.63	1.91	20	1.31	2.08
Soy sauce	18	16.38	1.32	20	16.20	2.08

12 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	31	216.43	173.30	29	247.56	189.51
Wheat/Prod.	31	33.88	47.29	29	19.89	38.64
Other Cereals	31	296.75	212.51	29	278.63	246.14
Starch Tubers	31	171.57	98.49	29	177.28	127.63
Legume prod.	31	43.17	38.32	29	46.40	54.69
Fresh fruit	31	61.10	60.63	29	23.76	19.47
Animal meat	31	10.68	13.51	29	15.38	20.48
Animal viscera	31	1.33	4.75	29	0.26	0.70
Paultry	31	0.82	0.25	29	0.71	2.34
Milk/Prod.	31	0.11	0.59	29	0.00	0.00
Eggs/Prod.	31	13.93	67.99	29	5.91	10.83
Fish/Shellfish	31	0.20	0.62	29	0.07	0.31
Vegetables	31	587.46	143.53	29	640.01	129.87
Vegetable oil	31	4.57	4.40	29	4.75	3.23
Animal fat	31	16.85	9.09	29	12.59	5.61
Salt	31	7.45	3.24	29	7.15	2.56
Vinegar	31	2.80	3.08	29	2.24	2.79
Soy sauce	31	16.45	4.08	29	15.90	2.28
Female						
Rice/Prod.	40	165.03	145.67	41	247.36	169.65
Wheat/Prod.	40	28.02	36.72	41	25.68	40.23
Other Cereals	40	314.25	196.22	41	262.97	196.24
Starch Tubers	40	126.00	99.47	41	158.77	143.77
Legume prod.	40	55.90	30.36	41	60.53	62.92
Fresh fruit	40	44.85	55.09	41	41.68	50.22
Animal meat	40	7.29	8.11	41	6.37	8.91
Animal viscera	40	0.88	3.05	41	0.32	0.79
Paultry	40	0.18	0.45	41	0.76	2.79
Milk/Prod.	40	0.00	0.00	41	0.00	0.00
Eggs/Prod.	40	5.09	9.44	41	5.49	9.51
Fish/Shellfish	40	0.05	0.20	41	0.12	0.57
Vegetables	40	641.50	139.76	41	621.09	132.08
Vegetable oil	40	4.33	3.91	41	5.65	4.36
Animal fat	40	14.85	7.81	41	13.27	5.99
Salt	40	6.87	2.36	41	6.51	2.08
Vinegar	40	2.44	2.84	41	2.92	2.54
Soy sauce	40	15.46	2.86	41	15.76	1.93

18 mos.

Food	Active group			Control group		
	N	Mean	SD	N	Mean	SD
Male						
Rice/Prod.	16	268.40	128.43	26	281.36	80.51
Wheat/Prod.	16	34.28	25.85	26	22.95	24.73
Other Cereals	16	268.75	107.82	26	282.88	126.95
Starch Tubers	16	40.99	32.61	26	50.14	21.18
Legume prod.	16	39.68	18.07	26	31.10	17.04
Fresh fruit	16	22.62	15.25	26	17.90	8.21
Animal meat	16	44.73	22.55	26	44.66	21.16
Animal viscera	16	0.15	0.32	26	0.19	0.66
Paultry	16	0.54	0.65	26	0.42	0.50
Milk/Prod.	16	0.00	0.00	26	0.00	0.00
Eggs/Prod.	16	3.29	2.13	26	2.89	2.03
Fish/Shellfish	16	0.02	0.07	26	0.00	0.00
Vegetables	16	595.13	135.42	26	596.67	132.80
Vegetable oil	16	1.73	2.12	26	2.08	1.88
Animal fat	16	14.69	3.06	26	14.99	3.06
Salt	16	4.25	1.62	26	3.38	0.97
Vinegar	16	1.21	1.67	26	1.19	1.72
Soy sauce	16	16.17	1.52	26	16.13	2.38
Female						
Rice/Prod.	12	247.97	117.73	26	196.70	98.93
Wheat/Prod.	12	21.42	17.05	26	14.26	12.61
Other Cereals	12	233.33	93.74	26	263.46	119.63
Starch Tubers	12	42.33	27.01	26	40.80	23.75
Legume prod.	12	30.46	13.68	26	33.21	19.53
Fresh fruit	12	19.32	12.45	26	16.55	9.71
Animal meat	12	44.06	18.53	26	41.05	13.80
Animal viscera	12	0.16	0.25	26	0.00	0.00
Paultry	12	0.34	0.52	26	0.33	0.48
Milk/Prod.	12	0.00	0.00	26	0.00	0.00
Eggs/Prod.	12	3.47	2.82	26	2.42	2.66
Fish/Shellfish	12	0.00	0.00	26	0.00	0.00
Vegetables	12	641.33	125.77	26	597.65	143.75
Vegetable oil	12	1.60	2.44	26	1.46	1.78
Animal fat	12	15.02	3.27	26	15.15	2.88
Salt	12	4.19	1.27	26	3.72	1.27
Vinegar	12	0.90	1.64	26	0.68	1.53
Soy sauce	12	15.94	1.81	26	15.68	3.97