EFFECT OF THE MOTHER'S NUTRITIONAL LEVEL ON STUNTING IN CHILDREN IN NEPAL

Group 21
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Abstract

This study aims to understand the impact of a mother's nutritional level on the prevalence of stunting in children between 6 months to 24 months of age in Nepal using the annual 2015 POSHAN survey results. Statistical analysis confirms the alignment of X variables with research hypotheses. Maternal health, indicated by average mid-upper arm circumference (MUAC), significantly reduces the likelihood of child stunting, along with improved water treatment, indoor defecation practices, increased breastfeeding frequency, lower maternal stress, and higher household expenditure. Moreover, residing in hills and terai regions reduces stunting odds compared to mountainous areas. An interaction term highlights that maternal MUAC's effect on stunting varies with reported stress levels. The final logistic model with the interaction term correctly classifies 72.32% of all observed cases. 6.50% are correctly classified positive cases of stunting and 97.51% correctly classified negative cases of non-stunting indicating that the model is better at predicting negative cases of child stunting as compared to positive cases. The model's limitations include the inability to establish causality due to simultaneous measurement of exposure and outcome, potential biases due to various missing and not applicable datapoints, simplification of complex variables restricting comprehensive analysis and potential omitted variable bias arising due to unmeasured confounding variables.

Contents

Research Question

Research question: What is the effect of mother's nutritional level on the prevalence of stunting in children between 6 months to 24 months of age in Nepal?

Research hypothesis: Mother's nutritional status (X_1) has an impact on stunting in children (Y).

Underlying theory: This research is rooted in the understanding that maternal nutritional status has a significant impact on a child's growth and development, including health outcomes post birth. In our study, we rely on mid-upper arm circumference (MUAC), a simple and reliable tool, to gauge mother's nutrition (categorized as under, ideal and over weight in this research.) Stunting, which is chiefly due to recurring or chronic malnutrition, is studied by examining the influence of a variety of factors like mother's nutrition, household food security, sanitation practices, access to clean water etc. on it.

Utility of research and target audience: This research is useful for policymakers, healthcare professionals and organizations which are interested in child and maternal health interventions. The results of this research will not only help in identifying the 'vulnerable' in need of support, but also in designing intervention models which target nutrition of pregnant mothers to ensure the birth of a healthy child.

Literature review: On the whole, the existing literature supports our hypothesis that there is a negative association between maternal nutrition and childhood stunting. Further, impact of other identified factors such as gender disparities, hygiene habits, food insecurity etc. also have an impact on stunting.

a. *Maternal nutritional status*: Studies have shown that infants born to mothers with low MUAC were more likely to be stunted, with prevalence of stunting in infants being nearly 48.8% (Kpeow et. al. 2020.) It is also suggested that stunting begins even before the birth of the child, and that infants born to mothers with low MUAC levels have a higher risk of being stunted than those born to mothers with normal MUAC (Kpewou et. al. 2020.)

Further, maternal malnutrition also significantly affected the linear growth of the fetus and increased the risk of stunting post birth (Santosa et. al. 2022.)

b. *Water, sanitation and hygiene (WASH) practices*: WASH practices also play a crucial role in childhood stunting and their nutritional outcomes. Research emphasizes that improved hygiene and sanitation habits reduce the risk of stunting in children under the age of five in rural settings and that contaminated hand pumps and tank water resources were a major contributing factor to childhood stunting (Rah et. al. 2015; Batool et. al. 2023.) Also, a beneficial effect was observed for good WASH practices on improving the diet and nutritional status of women (that is, a decrease in mother's with low MUAC) during and after pregnancy (Anyanwu et. al. 2022.)

c. *Household food insecurity*: Household food insecurity is also a determinant of stunting in children. It has been identified as a key driver of stunting initiatives in Nepal, as well as in addressing maternal and child nutrition (Conway et. al. 2020.) Further, a clear association was established between MUAC, childhood stunting, and household food insecurity, underscoring the linkages between mother's health, child well-being and access to food (Singh et. al. 2014.)

d. *Gender disparities*: Gender disparities in childhood stunting have also been observed, with boys exhibiting a higher prevalence of stunting compared to girls, with boys having a 49% higher chance of stunting than girls (Sahiledengle et. al. 2023.) A study, which investigated the early life mechanisms underlying sex differences in childhood malnutrition, highlighted that boys display greater vulnerability especially in socioeconomically deprived situations (Thurstans et. al. 2022.)

Data and Methods

Our data came from a series of annual surveys known as the Policy and Science for Health, Agriculture, and Nutrition (PoSHAN) Surveys in Nepal that were conducted from 2013 to 2015 by the Feed the Future Innovation Lab for Nutrition, funded by USAID. These surveys aimed to assess the nutritional status, diet, and health of preschool-aged children, their mothers, and newly married, nulliparous women, along with household food security, agricultural practices, and participation in services and programs. The overarching goal was to examine the connections between agricultural practices and various aspects of food security, nutrition, diet, and health, with the aim of guiding policy and program interventions to improve household food security, poverty, and the well-being of preschool children and their mothers. Covering 21 sub-district units (Village Development Committees, VDCs) across 21 districts, with 7 VDCs each in the Mountains, Hills, and Terai (plains), the surveys employed systematic sampling methods. Conducted during the same season (approximately June-August) every year, these surveys provided consistent data. The collection includes cross-sectional datasets from 2013 to 2015, formatted for STATA, MS Excel, and CSV, with data specificity limited to the regional district level for public access to maintain participant anonymity.

For our analysis we have used datasets from 3 surveys: Household, Child, Women. The 3 datasets were combined using the household and women ids. Given the cross-sectional nature of our analysis, we chose the most recent annual datasets from 2015. Combining the datasets we had a total sample size of 1842 children. Our Y variable is the stunting status of the children and is a dummy variable (0 is not stunted, 1 stunted). Our dataset only took into consideration children between the ages of 6 months to 24 months as for the first 6 months children primarily consume breast milk and thus it would be hard to measure other factors that could affect a child's stunting status. Also, the first 6 months are too early for a child to reflect stunting (i.e. very few Y=1 data points for this age category in our dataset). 6-24 months is when a child is breastfed but also consumes other solid foods and thus a mother's nutritional status would have an effect on the child's stunting status and a larger number of positive cases of stunting was prevalent in this age group in our dataset as compared to under 6 months. Post 24 months, it is not mandatory for the mother to breastfeed thus there will not be a direct pass over of the mother's nutrition levels to the child. Thus, we did not take into consideration children who are older than 24 months. Our datasets are representative of the larger Nepalese population as the survey covers a range of regions (hills, mountains, terai) and multiple sub-district units. The variables that we chose from our dataset had many data points that were classified as "Not Applicable"/"Missing"/"Do Not Know" which we recoded as "." in the new variables we created to use in our analysis. To understand the impact of mother's nutrition and health on a child's stunting status we used the mother's Mid-Upper Arm Circumference (MUAC) as our main X1 variable. MUAC is a measure of the sum of the muscle and subcutaneous fat in the upper arm. In severe malnutrition both fat and muscle are reduced in the upper arm and thus it is a useful tool for a fast assessment of nutritional status.[1] In terms of control variables that confound with the mother's nutritional status and could potentially impact the stunting status of children, we wanted to look into socio-economic status of the family, dietary diversity of the child, gender disparity within the family, mother's sickness status and stress levels, household food insecurity, WASH practices, regional disparities and breastfeeding practices. To measure socio-economic status of the family, we did not have variables that indicated household or parent income or education levels, thus we used total household expenditure and household food insecurity. Expenditure on children's education was avoided as that would be affected by the number of school-going children in a household. Healthcare expenditure was also not utilized as expenditure on healthcare is not solely a function of socio-economic status but instead a function of health conditions needing treatment. We

[1] J. Eaton–Evans. "Arm Circumference." Arm Circumference - an Overview | ScienceDirect Topics, Encyclopedia of Human Nutrition (Second Edition), 2005, www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/arm-circumference#:~:text=MUAC%20can%20be%20used%20as,than%2012.5%20cm%20suggests%20malnutrition.

determined that household food insecurity is an effective measurement of socio-economic status, particularly in a low-income rural household. For dietary diversity, we looked into the number of times particular foods were consumed **in a week** including legumes, curd, peanuts, milk, protein. These foods were chosen based on existing literature that indicated a strong relation between these foods and stunting levels in children. We decided not to choose the number of times these foods were consumed **in a day** as not all types of foods are consumed on a daily basis irrespective of socio-economic status, culture and region. To understand any potential gender disparities, we looked at the child's sex to see if women are treated in a different way (given more care in terms of nutrition) if she has a male child as compared to female. Additionally, women's empowerment and involvement in household decision-making have been shown to have important consequences for children's nutrition: studies in Bangladesh have shown that children of mothers with less involvement in decision-making have an increased risk of low birthweight and increased likelihood of stunting.[2] For this reason, we chose to analyze household expenditure decision making from a gender lens. We clubbed the different response categories into the following 3 categories: female decision maker only, male decision maker only, joint decision making between male and female. For the mother's ongoing sickness status, we looked at whether the mother had nausea, vomiting and/or poor appetite over the past 30 days as these were more indicative of temporary sickness that could bias the results of MUAC Average (possibly cause a decrease in weight temporarily). Given that the functional status of water schemes and the quality of water remains poor in Nepal with 71 per cent of all water sources and 91 per cent of those used by the poorest quintile contaminated with Escherichia coli bacteria and open defecation is still practiced by 16 percent of the population (NDHS)[3], we chose to analyze variables that describe the location of the defecation practices (indoor vs outdoor) and whether water is treated before drinking to

[2] Salinger, A.P., Vermes, E., Waid, J.L. et al. The role of self-efficacy in women's autonomy for health and nutrition decision-making in rural Bangladesh. BMC Public Health 24, 338 (2024). https://doi.org/10.1186/s12889-024-17663-2
[3] "Water and Sanitation (WASH)." UNICEF, www.unicef.org/nepal/water-and-sanitation-wash.

make it safe, to determine WASH practices for our sample. Finally, to assess mother's stress levels, we chose the survey question "If respondent felt sad all the time within 30 days". We chose this question over other questions around "hurting oneself", "becoming more forgetful", "sleeping more than ever" as these could be due to post-partum depression, other traumatic events and in some cases such as becoming more forgetful, just a light coincidence. We solely wanted a measure that indicates a women's current/temporary stress level that might temporarily affect her nutritional/health status and might thereby exaggerate the effect of MUAC average on child stunting.

Results and Discussion

Summary Statistics[4]

Variable	Variable Name	Variable Type	Variable Label	Details
Y	stuntstat[5]	dummy	stunting status of children	0 - not stunted (74.13%), 1 - stunted (25.87 %)
X1	muacavg[6]	continuous	avg of 3 MUACs taken of the mother	min - 17.5, max - 37.1, Mean - 24.56, SD - 3.00
X2	HHfoodinsec	categorical	household food insecurity	1 - none (79.34%), 2 - mild (8.43%), 3 - moderate (8.37%), 4 - severe (3.86%)
X3	Childsex	dummy	sex of child	0 - male (51.49%), 1 - female (48.51%)
X4	treatwater	dummy	is the water treated before drinking to make it safe	0 - no (81.96%), 1 - yes (18.04%)
X5	defpract	dummy	where do children defecate or defecation practices	0 - outdoor (45.34%), 1 - indoor (54.66%)

[4] Refer to Table X in the Appendix for details about how each variable is measured.
[5] Refer to Figure A in Appendix for visualization.
[6] Refer to Figure B in Appendix for visualization.

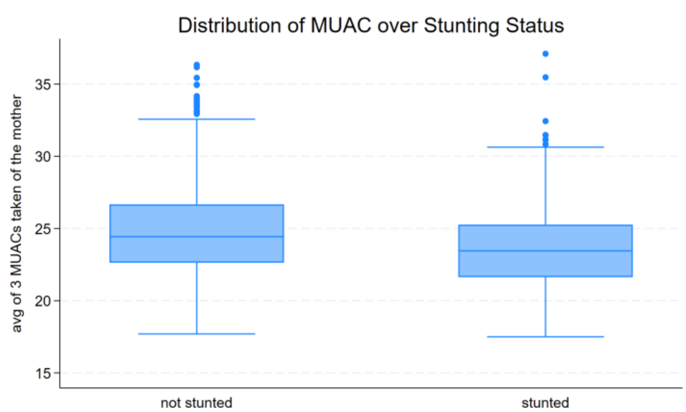
X6	brstfeedpract	categorical	average number of times child breastfed per day in the last 7 days	1 - none (6.13%), 2 - 1 to 10 times (59.84%), 3 - 11 to 20 times (27.11%), 4 - 21 or more times (6.92%)
X7	HHexp	categorical	total household expenditure (Rs.) during the last 30 days	1 - Low expense: min-7999 (23.02%), 2 - Medium expense: 8000-19999 (47.56%), 3 - High expense: 20000-max (29.42%) where min = 200, max = 99,99,997
X8	motherage	discrete	mother's age	min - 15, max - 58, mean - 25.27, SD - 5.22
X9	motherstress	dummy	if respondent felt sad all the time in the last 30 days	0 - no (88.07%), 1 - yes (11.93%)
X10	expdecision	categorical	who normally takes the decision regarding daily HH expenditures	1 - female only (51.33 %), 2 - male only (32.27%), 3 - female and spouse (16.39%)
X11	mothersicknesstatus	categorical	mother's current ongoing sickness status	0 - no sickness (88.69%), 1 - mild sickness (7.88%), 2 - moderate sickness (2.48%), 3 - severe Sickness (0.96%)
X12	region	categorical	agro-ecological regions : mountains / hills / terai	1 - Mountains (12.32%), 2 - Hills (25.52%), 3 - Terrai (62.16%)
X13	legumecons	continuous	no. of times legumes (chickpeas, dried peas, lima beans & soybeans) were consumed within last 7 days	min - 0, max -35 , mean - 0.934, SD - 2.372
X14	peanutcons	continuous	no. of times peanuts were consumed within last 7 days	min - 0, max - 28, mean - 0.255, SD - 1.498
X15	milkcons	continuous	no. of times milk was consumed within last 7 days	min - 0, max - 56, mean - 6.481, SD - 8.158

X16	curdcons	continuous	no. of times curd was consumed within last 7 days	min - 0, max - 21, mean - 0.535, SD - 2.082
X17	proteincons	continuous	no. of times chicken/duck were consumed within last 7 days	min - 0, max - 25, mean - 0.637, SD - 1.290

Exploratory Data Analysis

Exploring distribution of quantitative response variable (X1) across the dichotomous Y and comparing the mean on the quantitative response variable (X1) across the dummy subcategories.

Box and Whisker Plot 1:



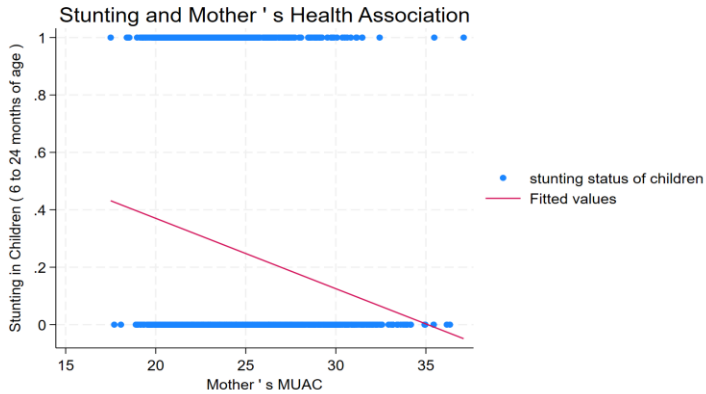
Summary Table 1:

```
. tab stuntstat, summarize (muacavg)

   stunting | Summary of avg of 3 MUACs taken of
  status of |             the mother
   children |        Mean   Std. dev.       Freq.
------------+------------------------------------
  not stunt |   24.854087   3.0256507       1,301
    stunted |   23.698532   2.7843307         454
------------+------------------------------------
      Total |   24.555157   3.0072335       1,755
```

Findings: The mean MUAC is higher for children who are not stunted as compared to stunted, as evident from Box and Whisker Plot 1 and Summary Table 1, which is aligned with our hypothesis as a higher MUAC Average is indicative of better health and nutrition of the mother in our analysis.

Scatterplot 1:



Correlation Matrix 1:

```
. pwcorr stuntstat muacavg

             | stunts~t  muacavg
-------------+------------------
   stuntstat |   1.0000
     muacavg |  -0.1683   1.0000
```

Findings: The scatterplot visualizes a negative association between the stunting status of children (Y) and mother's nutritional status (X1). The correlation matrix suggests a weak negative association between Y and X1.

LPM Regression Results (Naive Approach) and Checking for Multicollinearity

LPM Regression:

```
. regress stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract
i.brstfeedpract i.HHexp motherage i.motherstress i.expdecision i.mothersic
> knesstatus c.muacavg##i.motherstress i.region legumecons peanutcons milkcons curdcons
proteincons
note: muacavg omitted because of collinearity.

      Source |       SS           df       MS      Number of obs   =     1,279
-------------+----------------------------------   F(27, 1251)     =      3.66
       Model |  18.7202883        27  .693344011   Prob > F        =    0.0000
    Residual |  237.30004      1,251  .189688281   R-squared       =    0.0731
-------------+----------------------------------   Adj R-squared   =    0.0531
       Total |  256.020328     1,278  .200328895   Root MSE        =    .43553

------------------------------------------------------------------------------------------
               stuntstat | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------------------+----------------------------------------------------------------
                 muacavg |   -.016737   .0048364    -3.46   0.001    -.0262253   -.0072488
                         |
             HHfoodinsec |
```

```
              mild  |    .005068   .0451043     0.11   0.911    -.0834204    .0935563
          moderate  |   .0098908   .0463793     0.21   0.831    -.0810991    .1008806
            severe  |   -.014278   .0593309    -0.24   0.810     -.130677    .1021211
                    |
          childsex |
            female  |    .006983   .0247363     0.28   0.778    -.0415462    .0555121
                    |
        treatwater |
               yes  |  -.0883692   .0416888    -2.12   0.034     -.170157   -.0065815
                    |
          defpract |
            indoor  |  -.0908483    .026964    -3.37   0.001    -.1437479   -.0379487
                    |
     brstfeedpract |
        1-10 times  |  -.0797581   .0535768    -1.49   0.137    -.1848684    .0253522
       11-20 times  |  -.1545191   .0559601    -2.76   0.006     -.264305   -.0447331
   21 or more times |  -.1311376   .0675709    -1.94   0.053    -.2637024    .0014272
                    |
             HHexp |
    Medium Expense  |  -.0464124   .0302554    -1.53   0.125    -.1057693    .0129445
      High Expense  |   -.060956   .0362572    -1.68   0.093    -.1320877    .0101757
                    |
         motherage |   .0081362   .0023245     3.50   0.000     .0035759    .0126964
                    |
      motherstress |
               yes  |   .8659596   .3357136     2.58   0.010     .2073358    1.524583
                    |
       expdecision |
         male only  |  -.0333392   .0276194    -1.21   0.228    -.0875247    .0208463
 female and spouse  |  -.0180216   .0369592    -0.49   0.626    -.0905304    .0544873
                    |
mothersicknesstatus |
     Mild sickness  |  -.0174111   .0464428    -0.37   0.708    -.1085254    .0737032
 Moderate sickness  |   .0705142    .077747     0.91   0.365    -.0820147    .2230432
   Severe sickness  |   .0538249   .1200129     0.45   0.654    -.1816238    .2892736
                    |
          muacavg |          0  (omitted)
                    |
motherstress#c.muacavg |
               yes  |  -.0350593   .0138343    -2.53   0.011    -.0622003   -.0079183
                    |
            region |
             Hills  |  -.1210535   .0474706    -2.55   0.011    -.2141843   -.0279228
             Terai  |  -.1377697    .045745    -3.01   0.003     -.227515   -.0480243
                    |
        legumecons |  -.0004076   .0061372    -0.07   0.947     -.012448    .0116327
       peanutcons |   -.005002   .0130853    -0.38   0.702    -.0306737    .0206696
          milkcons |  -.0006622   .0016628    -0.40   0.691    -.0039243    .0025999
          curdcons |  -.0006393   .0062278    -0.10   0.918    -.0128573    .0115787
       proteincons |  -.0092584   .0097016    -0.95   0.340    -.0282916    .0097748
             _cons |   .8096963   .1405347     5.76   0.000     .5339866    1.085406
------------------------------------------------------------------------------------------
```

Findings: As expected, the linear probability model suggests a negative association between mother's health (X1) and stunting in children (Y), holding all other variables constant. The estimated coefficient of mother's nutritional level is statistically significant, differing from zero.

Multicollinearity Check (Vif):

```
. vif

    Variable |       VIF       1/VIF  
-------------+----------------------
     muacavg |      1.31    0.762423
```

HHfoodinsec		
2	1.11	0.897935
3	1.15	0.869954
4	1.09	0.913412
1.childsex	1.03	0.970029
1.treatwater	1.41	0.708966
1.defpract	1.22	0.822367
brstfeedpr~t		
1	4.69	0.213030
2	4.21	0.237428
3	2.24	0.446606
HHexp		
2	1.54	0.649456
3	1.70	0.588146
motherage	1.08	0.924446
1.motherst~s	76.84	0.013013
expdecision		
2	1.15	0.872179
3	1.16	0.858390
mothersick~s		
1	1.06	0.945384
2	1.05	0.948190
3	1.05	0.951124
motherstress# c.muacavg		
1	76.11	0.013138
region		
2	2.70	0.370013
3	3.18	0.314398
legumecons	1.08	0.922797
peanutcons	1.14	0.878969
milkcons	1.09	0.920849
curdcons	1.14	0.878173
proteincons	1.04	0.957179
Mean VIF	7.17	

Findings: All values are within the acceptable range (well below 10) and multicollinearity has been ruled out for this model specification. The vif on the interaction term and mother's stress level is approximately 76, however this is not a cause of concern as collinearity is expected due to the statistically significant interaction.

Logit Regression Results (without interaction term)

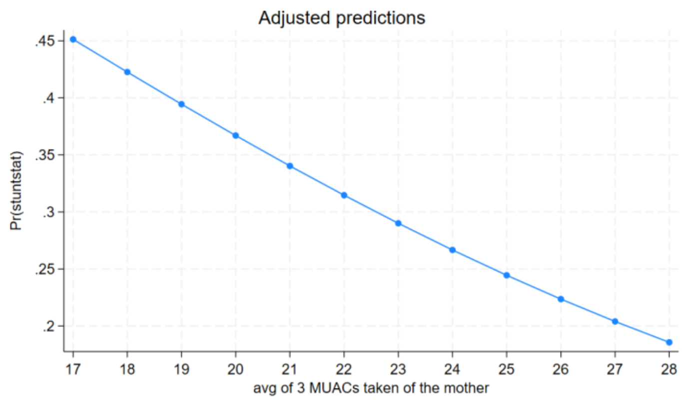
```
. //Logit results (without interaction term)
. logit stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract
i.brstfeedpract i.HHexp motherage i.motherstress i.expdecision i.mothersicknesstatus
i.region legumecons peanutcons milkcons curdcons proteincons

Iteration 0:  Log likelihood = -754.46312
Iteration 1:  Log likelihood = -709.65845
Iteration 2:  Log likelihood = -708.46217
Iteration 3:  Log likelihood =  -708.4572
Iteration 4:  Log likelihood =  -708.4572

Logistic regression                                     Number of obs =  1,279
                                                        LR chi2(26)   =  92.01
                                                        Prob > chi2   = 0.0000
Log likelihood = -708.4572                              Pseudo R2     = 0.0610

------------------------------------------------------------------------------------
          stuntstat | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
--------------------+---------------------------------------------------------------
            muacavg |  -.1165943   .0259601    -4.49   0.000    -.1674751   -.0657135
                    |
        HHfoodinsec |
              mild  |   .0430123   .2325667     0.18   0.853      -.41281    .4988346
          moderate  |   .0705301   .2341973     0.30   0.763    -.3884882    .5295484
            severe  |  -.0488593   .2994821    -0.16   0.870    -.6358335    .5381148
                    |
           childsex |
            female  |   .0325968   .1314569     0.25   0.804     -.225054    .2902476
                    |
         treatwater |
               yes  |  -.5481538   .2460666    -2.23   0.026    -1.030435   -.0658721
                    |
           defpract |
            indoor  |  -.4764894   .1429461    -3.33   0.001    -.7566585   -.1963202
                    |
      brstfeedpract |
        1-10 times  |   -.399011   .2693701    -1.48   0.139    -.9269668    .1289448
       11-20 times  |  -.7998466   .2860468    -2.80   0.005    -1.360488   -.2392052
   21 or more times |  -.6976635   .3543232    -1.97   0.049    -1.392124   -.0032028
                    |
              HHexp |
    Medium Expense  |  -.2307056   .1552098    -1.49   0.137    -.5349111    .0734999
      High Expense  |   -.307868   .1939528    -1.59   0.112    -.6880085    .0722724
                    |
          motherage |   .0414877   .0119751     3.46   0.001     .0180169    .0649585
                    |
       motherstress |
               yes  |   .1102916   .2088981     0.53   0.598    -.2991411    .5197244
                    |
        expdecision |
         male only  |  -.1795487   .1485167    -1.21   0.227    -.4706361    .1115387
  female and spouse |  -.0710248   .1954157    -0.36   0.716    -.4540325    .3119829
                    |
mothersicknesstatus |
      Mild sickness |  -.0806866   .2463374    -0.33   0.743    -.5634991    .4021259
  Moderate sickness |     .39558   .3790397     1.04   0.297    -.3473241    1.138484
    Severe sickness |   .3211034   .6220768     0.52   0.606    -.8981446    1.540351
                    |
             region |
             Hills  |  -.6467429   .2484165    -2.60   0.009     -1.13363   -.1598555
             Terai  |   -.718259   .2352095    -3.05   0.002    -1.179261    -.257257
                    |
         legumecons |  -.0012402   .0331417    -0.04   0.970    -.0661968    .0637164
         peanutcons |  -.0530025   .0919546    -0.58   0.564    -.2332302    .1272252
           milkcons |  -.0028143   .0089316    -0.32   0.753      -.02032    .0146914
           curdcons |  -.0024066    .032125    -0.07   0.940    -.0653704    .0605573
        proteincons |  -.0543527   .0575771    -0.94   0.345    -.1672018    .0584965
              _cons |   2.465224   .7433917     3.32   0.001     1.008203    3.922245
```

Marginsplot of X1 (using regression without interaction term):



Findings (without interaction term):

The marginsplot output provides the adjusted model predicted probabilities of stunting (Y=1) for different values of MUAC average, with all other predictor control variables at their mean values. At MUAC's minimum value of 17, the model predicts a probability of stunting as 0.451, with a standard error of 0.048 and so on for each level of MUAC up to 28, which is its maximum value. As evident from the marginsplot above, the predicted probability of Y=1/stunting decreases as MUAC average values increase. This is aligned with our hypothesis that the better a women's health indicated by higher values of Average MUAC, the lower the probability of child stunting.

Final Logit Regression Results (with interaction term)

Base specification:

Pi / (1-Pi) = e^(β0 - β1 (muacavg) + β2 (HHfoodinsec) + β3 (Childsex) - β4 (treatwater) - β5 (defpract) - β6 (brstfeedpract) - β7 (HHexp) + β8 (motherage) + β9 (motherstress) + β10 (muacavg##motherstress) + β11 (expdecision) + β12 (mothersicknesstatus) + β13 (region) + β14 (legumecons) - β15 (peanutcons) - β16 (milkcons) + β17 (curdcons) - β18 (proteincons)) + Ei

```
. //Logit results (with interaction term)
. logit stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract
i.brstfeedpract i.HHexp motherage i.motherstress i.expdecision i.
```

```
> mothersicknesstatus c.muacavg##i.motherstress i.region legumecons peanutcons milkcons
curdcons proteincons

note: muacavg omitted because of collinearity.
Iteration 0:  Log likelihood = -754.46312
Iteration 1:  Log likelihood = -706.68075
Iteration 2:  Log likelihood = -705.26886
Iteration 3:  Log likelihood = -705.26414
Iteration 4:  Log likelihood = -705.26414

Logistic regression                                     Number of obs =  1,279
                                                        LR chi2(27)   =  98.40
                                                        Prob > chi2   = 0.0000
Log likelihood = -705.26414                             Pseudo R2     = 0.0652

--------------------------------------------------------------------------------------
             stuntstat | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-----------------------+--------------------------------------------------------------
               muacavg |  -.0941159   .0272137    -3.46   0.001    -.1474537    -.040778
                       |
           HHfoodinsec |
                 mild  |   .0327333    .233746     0.14   0.889    -.4254005    .4908671
             moderate  |   .0408577   .2363994     0.17   0.863    -.4224767    .5041921
               severe  |  -.0627731   .3032692    -0.21   0.836    -.6571698    .5316236
                       |
              childsex |
               female  |   .0222016   .1319552     0.17   0.866    -.2364258     .280829
                       |
            treatwater |
                  yes  |  -.5602995   .2471381    -2.27   0.023    -1.044681   -.0759177
                       |
              defpract |
               indoor  |   -.493545   .1437204    -3.43   0.001    -.7752319   -.2118582
                       |
          brstfeedpract|
            1-10 times |  -.4093818   .2692826    -1.52   0.128    -.9371659    .1184023
           11-20 times |  -.8198757   .2864483    -2.86   0.004    -1.381304   -.2584473
      21 or more times |  -.6784855   .3544241    -1.91   0.056    -1.373144    .0161731
                       |
                 HHexp |
        Medium Expense |  -.2281148   .1557116    -1.46   0.143    -.5333039    .0770743
          High Expense |  -.3270355   .1948133    -1.68   0.093    -.7088627    .0547916
                       |
             motherage |   .0411507   .0120487     3.42   0.001     .0175357    .0647657
                       |
          motherstress |
                  yes  |   5.138183   2.112148     2.43   0.015     .9984478    9.277917
                       |
           expdecision |
            male only  |  -.1845411   .1489825    -1.24   0.215    -.4765415    .1074593
     female and spouse |   -.081131   .1964397    -0.41   0.680    -.4661458    .3038838
                       |
   mothersicknesstatus |
         Mild sickness |  -.0939135   .2482536    -0.38   0.705    -.5804816    .3926545
     Moderate sickness |   .3558571     .38211     0.93   0.352    -.3930648    1.104779
       Severe sickness |   .2250747   .6397795     0.35   0.725     -1.02887     1.47902
                       |
               muacavg |          0  (omitted)
                       |
motherstress#c.muacavg |
                  yes  |  -.2134848   .0898644    -2.38   0.018    -.3896157   -.0373539
                       |
                region |
                Hills  |  -.6552076    .250003    -2.62   0.009    -1.145205   -.1652107
                Terai  |  -.7318287   .2370617    -3.09   0.002    -1.196461   -.2671962
                       |
            legumecons |   -.001617   .0330861    -0.05   0.961    -.0664646    .0632306
            peanutcons |   -.049752   .0916955    -0.54   0.587    -.2294719    .1299679
              milkcons |   -.003054   .0089564    -0.34   0.733    -.0206083    .0145002
              curdcons |  -.0035499     .03218    -0.11   0.912    -.0666216    .0595218
           proteincons |  -.0536405   .0576258    -0.93   0.352    -.1665851    .0593041
```

```
_cons |   1.985275   .7640704     2.60   0.009     .4877249    3.482826
------------------------------------------------------------------------------
```

Table of final multivariate regression results:

#	Variables	Coef.	Std.err.	Interpretation
X1	**muacavg**	-.0941159***	.0272137	The MUAC average is statistically significant(p = 0.001). **Coefficient interpretation:** For every one-unit increase in maternal upper arm circumference (MUAC), on average, the log odds of being stunted decrease by approximately .094 units, assuming all other variables are constant. Or : For every one-unit increase in maternal upper arm circumference (MUAC), on average, the odds of being stunted decrease by approximately 10%, holding all variables constant.
X2	**HHfoodinsec**			
	mild	.0327333	.233746	Not statistically significant (p = 0.889). **Coefficient interpretation:** Compared to households with no food insecurity, for households with mild food insecurity, on average, the log odds of being stunted for children increase by 0.033 units, on average, holding all other variables constant. However, this change is not statistically reliable.
	moderate	.0408577	.2363994	Not statistically significant (p = 0.863). **Coefficient interpretation:** Compared to households with no food insecurity, for households with moderate food insecurity, on average, the log odds of being stunted increase by 0.041 units, on average, holding all other variables constant. However, this change is not statistically reliable.
	severe	-.0627731	.3032692	Not statistically significant (p = 0.836). **Coefficient interpretation:** Compared to households with no food insecurity, for households with severe food insecurity, on average, the log odds of being stunted decrease by 0.063 units, on average, holding all other variables constant. However, this change is not statistically reliable.
X3	**childsex** female	.0222016	.1319552	Not statistically significant (p = 0.866). **Coefficient interpretation:** Holding all other variables constant, on average, for female children the log odds of being stunted is .022 units higher compared to male children. However, this difference is not statistically significant.
X4	**treatwater** yes	-.5602995**	.2471381	Statistically significant (p =0.023) There is evidence to reject the null and conclude that *treatwater* has a significant effect on the stunting level among children, at the 0.05 significance level.

				Coefficient interpretation: Treating water is associated with a decrease in the log odds of stunting by approximately .560 units, with all other variables held constant. Or : Households that treat water, on average, have approximately 36% lower odds of stunting among children compared to households that do not treat water, holding other variables constant.
X5	**defpract** indoor	-.493545***	.1437204	Statistically significant (p = .001). There is significant evidence to reject the null and conclude that *defpract* has a significant effect on the stunting level among children, at the 0.01 significance level. **Coefficient interpretation:** Compared to households practicing outdoor defecation, on average, households practicing indoor defecation have a lower log odds of stunting among children by approximately 0.494 units, holding all other variables constant. Or : For households practicing indoor defecation, compared to households practicing outdoor defecation, on average, the odds of stunting among children decrease by approximately 39%, holding all other variables constant.
X6	**brstfeedpract**			
	1-10 times	-.4093818	.2692826	Not statistically significant (p = 0.128). **Coefficient interpretation:** Compared to households where breastfeeding is not practiced at all, in households where breastfeeding happens 1-10 times a week, children have, on average, a lower log odds of stunting by approximately 0.409 units, holding all other variables constant. However, this change is not statistically reliable.
	11-20 times	-.8198757***	.2864483	Statistically significant (p = .004). There is sufficient evidence to conclude that households where children are breastfed 11-20 times a week have a statistically significant difference in the log odds of stunting, compared to households where breastfeeding is not practiced at all, at the 0.01 significance level. **Coefficient interpretation:** Compared to households where breastfeeding is not practiced at all, in households where children are breastfed 11-20 times a week, children have, on average, a lower log odds of stunting by approximately .82 units, holding all other variables constant. Or : When children are breastfed within the range of 11-20 times, the odds of stunting, on average, decrease by approximately 56%, compared to children who are not breastfed at all, holding all other variables constant.
	<21 times	-.6784855*	.3544241	Statistically significant (p = .056). **Coefficient interpretation:** Compared to households where breastfeeding is not practiced at all, in households where breastfeeding happens 21 times and more per week, children have, on average, a

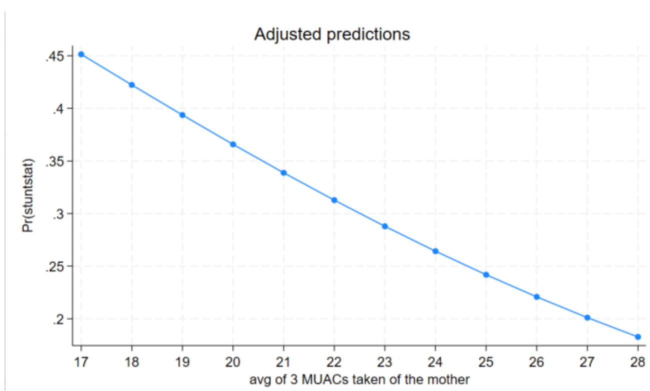
				lower log odds of stunting by approximately .678 units, holding all other variables constant. Or : When children are breastfed 21 times or more a week, the odds of stunting, on average, decrease by approximately 49%, compared to children who are not breastfed at all, holding all other variables constant.
X7	**HHexp**			
	Medium Expense	-.2281148	.1557116	Not statistically significant (p = .143). **Coefficient interpretation:** All else being equal, households with medium expenses are associated with a decrease in the log odds of stunting by .228 units, compared to households with low expenses. However, this difference is not statistically significant.
	High Expense	-.3270355*	.1948133	Statistically significant (p = .093). We reject the null and conclude that high household expenditure is significantly associated with the likelihood of stunting of children, at the .10 statistical significance level. **Coefficient interpretation:** All else being equal, households with high expenses are associated with a decrease in the log odds of stunting by .327 units, compared to households with low expenses.
X8	**motherage**	.0411507***	.0120487	Statistically significant (p = .001). We reject the null and conclude that maternal age is significantly associated with the likelihood of stunting of children, at the .01 statistical significance level. **Coefficient interpretation:** As maternal age increases by one unit, there is a 0.041 point increase in the log odds of stunting, after controlling for other factors in the model. Or : As mother's age increase by one year, the odds of stunting among their children, on average increase by a factor of 1.04, holding all other variables constant
X9	**motherstress** yes	5.138183**	2.112148	Statistically significant (p = .015). We reject the null and conclude that the presence of mother stress has a statistically significant effect on the likelihood of stunting, at the .05 significance level. **Coefficient interpretation:** On average, there is a 5.138 unit increase in the log odds of stunting of children, when the mothers experience stress, compared to when they are not stressed, holding all other variables constant. Or : When the mothers experience stress, compared to when they are not stressed, holding all other variables constant, the odds of stunting of their children increase, on average, by a factor of 170.
X10	**expdecision**			
	male only	-.1845411	.1489825	Not statistically significant (p = .215) **Coefficient interpretation:**

				Holding all other variables constant, male-run households are associated with a decrease in the log odds of stunting by approximately 0.185 units, compared to households headed by women. However, this difference is not statistically significant.
	female and spouse	-.081131	.1964397	Not statistically significant (p = .680) **Coefficient interpretation:** Holding all other variables constant, households jointly run by both female and spouse are associated with a decrease in the log odds of stunting by approximately .081 units, compared to households headed by women. However, this difference is not statistically significant.
X11	**mothersicknesstatus**			
	mild sickness	-.0939135	.2482536	Not statistically significant (p = .705) **Coefficient interpretation:** Holding all other variables constant, having a mother with mild sickness is associated with a decrease in the log odds of stunting by approximately 0.094 units, compared to when a mother does not have sickness. However, this difference is not statistically significant.
	moderate sickness	.3558571	.38211	Not statistically significant (p = .352) **Coefficient interpretation:** Holding all other variables constant, having a mother with mild sickness is associated with an increase in the log odds of stunting by approximately 0.356 units, compared to when a mother does not have sickness. However, this difference is not statistically significant.
	severe sickness	.2250747	.6397795	Not statistically significant (p = .725) **Coefficient interpretation:** Holding all other variables constant, having a mother with mild sickness is associated with an increase in the log odds of stunting by approximately 0.225 units, compared to when a mother does not have sickness. However, this difference is not statistically significant.
X12	**muacavg (interaction with motherstress)**	-.2134848**	.0898644	Statistically significant (p = .018). We reject the null and conclude that there is a significant interaction effect between maternal stress and maternal upper arm circumference on the log odds of stunting. **Coefficient interpretation:** For every one-unit increase in a mother's MUAC, the log odds of stunting decrease by approximately 0.213 units among mothers experiencing stress (motherstress = yes), as opposed to mothers with no reported stress, on average, holding all other variables constant. Or : For every one-unit increase in MUAC, among mothers experiencing stress (motherstress = yes), the odds of stunting decrease by approximately 19%, on average, compared to women with no stress, holding all other variables constant.
X13	**region**			

	hills	-.655207***	.250003	Statistically significant (p = .009) at the conventional level of p>.05. **Coefficient interpretation:** For households located in the hills, on average, the log odds of stunting decrease by approximately 0.655 units compared to the mountainous region, holding all other variables constant. Or : For households located in the hills, on average, the log odds of stunting among children on average decrease by approximately 48% compared to the mountainous region, holding all other variables constant.
	terai	-.731828***	.2370617	Statistically significant (p = .002). **Coefficient interpretation:** For households located in the terrains, on average, the log odds of stunting decrease by approximately 0.732 units compared to the mountainous region, holding all other variables constant. Or : For households located in the terrains, on average, the log odds of stunting among children on average decrease by approximately 52% compared to the mountainous region, holding all other variables constant.
X14	**legumecons**	-.001617	.0330861	Not statistically significant (p = .961) **Coefficient interpretation:** A one-unit increase in the consumption of legumes, on average, is associated with a .001 unit increase in the log odds of being stunted, holding all other variables constant.
X15	**peanutcons**	-.049752	.0916955	Not statistically significant (p = .587) **Coefficient interpretation:** A one-unit increase in the consumption of peanuts is associated with a .05 unit decrease in the log odds of being stunted, holding all other variables constant.
X16	**milkcons**	-.003054	.0089564	Not statistically significant (p = .733) **Coefficient interpretation:** A one-unit increase in the consumption of milk, on average, is associated with a .003 unit decrease in the log odds of being stunted, holding all other variables constant.
X17	**curdcons**	-.0035499	.03218	Not statistically significant (p = .912) **Coefficient interpretation:** A one-unit increase in the consumption of curds, on average, is associated with a .004 unit decrease in the log odds of being stunted, holding all other variables constant.
X18	**proteincons**	-.0536405	.0576258	Not statistically significant (p = .352) **Coefficient interpretation:** A one-unit increase in the consumption of proteins, on average, is associated with a .054 unit decrease in the log odds of being stunted, holding all other variables constant.
Cons	**Constant**	1.985275***	.7640704	Statistically significant (p = .009) **Coefficient interpretation:** The predicted stunting status when all x variables = 0 or reference category is 1.985.

Findings: The X variables that have statistical significance indicate associations that are aligned with our hypotheses. As expected, an increase in the average maternal upper arm circumference (MUAC) indicative of maternal health increases, decreases the probability of child stunting, assuming all other variables are constant. Similarly, as expected, treating water, practicing indoor defecation, a higher frequency of breastfeeding per week, lower stress levels of a mother and a higher socio-economic status reflected by higher household expenditure all decrease the probability of child stunting keeping all other variables constant. Interestingly, as maternal age increases by one unit, there is an increase in the odds of stunting, keeping all other factors constant. Also, residing in the hills and terai decreases the odds of stunting as compared to mountains, keeping all other factors constant. Additionally, this model has the interaction term which is significant and thus highlights that for every one-unit increase in a mother's MUAC, the log odds of stunting decrease by approximately 0.213 units among mothers experiencing stress as opposed to mothers with no reported stress, on average, holding all other variables constant. While the constant is significant, it doesn't hold much meaning as some X variables cannot equal to 0 such as the MUAC Average and region. Also, the coefficient of the constant is greater than 1 which in itself doesn't make much sense given that the probability of child stunting cannot be greater than 1.

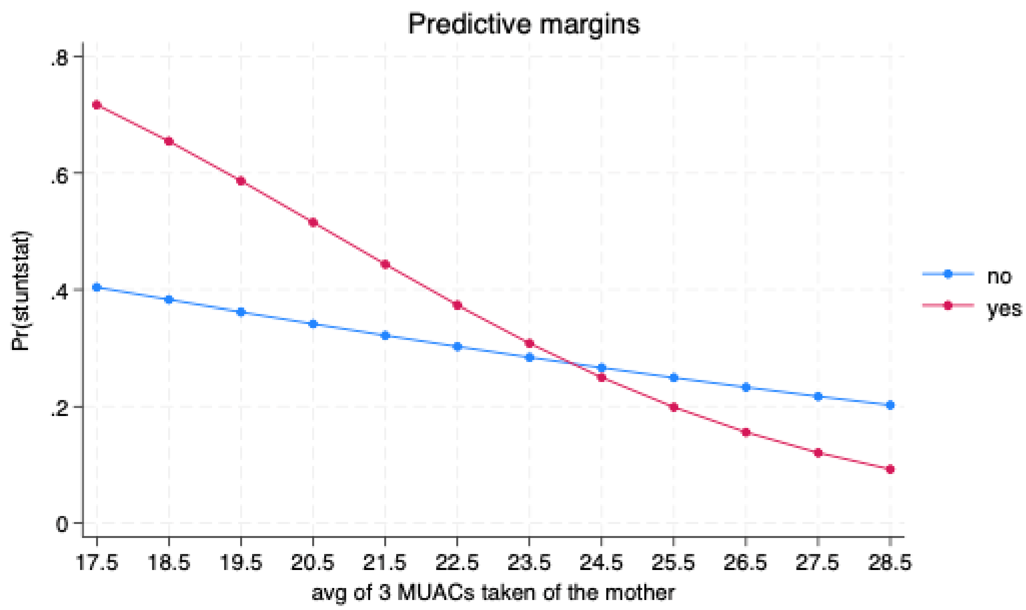
Marginsplot of X1 (using regression with interaction term):



Findings (with interaction term):

As evident, there is minimal difference in the marginsplots with and without the interaction term. At MUAC's minimum value of 17, the model predicts a probability of stunting as 0.451, with a standard error of 0.048 and so on for each level of MUAC up to 28, which is its maximum value. Our conclusion remains the same, the predicted probability of Y=1/stunting decreases as MUAC average values increase, which is aligned with our hypothesis.

Marginsplot for Interaction between MUAC Average and Mother's Stress Levels:



Findings: The interaction between MUAC Average and Mother's Stress has been included in the final specification, as it was the only one that showed statistical significance among other potential interaction variations considered during the analysis. The marginsplot above displays the model predicted probability of stunting (Y=1) for each level of MUAC Average for mothers with stress ("Yes" line) and no stress ("No" line). As apparent from the marginsplot above, as MUAC Average levels increase, the model predicted probability of stunting decreases for mother's that are stressed and for mother's that are not stressed. The rate of decrease in the probability of stunting is steeper for mothers who are stressed and the predicted probability of stunting of children, when mothers have the lowest MUAC and are stressed, is twice as high compared to mothers who also have the lowest MUAC but are not stressed. Notably, the predicted probability of stunting of children for women with stress continues to decrease when MUAC increases, at 24cm and above, falling below the predicted probability of stunting for women with no stress. It potentially suggests the neutralizing effect of the increased MUAC on how stress of mothers impacts the predicted probability of stunting among children.

Sensitivity and Specificity

```
. //Checking for sensitivity and specificity/soundness of model
. lstat

Logistic model for stuntstat

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |        23            23  |         46
     -     |       331           902  |       1233
-----------+--------------------------+-----------
   Total   |       354           925  |       1279

Classified + if predicted Pr(D) >= .5
True D defined as stuntstat != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)    6.50%
Specificity                     Pr( -|~D)   97.51%
Positive predictive value       Pr( D| +)   50.00%
Negative predictive value       Pr(~D| -)   73.15%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)    2.49%
False - rate for true D         Pr( -| D)   93.50%
False + rate for classified +   Pr(~D| +)   50.00%
False - rate for classified -   Pr( D| -)   26.85%
--------------------------------------------------
Correctly classified                        72.32%
--------------------------------------------------
```

The logistic model correctly classifies 72.32% of all observed cases.

Sensitivity: 6.50% are correctly classified positive cases of stunting.

Specificity: 97.51% correctly classified negative cases of non-stunting.

The model is better at predicting negative cases of child stunting as compared to positive cases.

Practical and Policy Implications of the Research

The results of the study indicate a significant relationship between the effect of a mother’s nutritional status and on the prevalence of stunting in children aged 6 to 24 months. This research area is of utmost importance because stunting in children, especially below 2 years of age, has become a significant global concern, especially in low-and-middle income countries, such as Nepal. Empirical research suggests that growth deficiencies experienced between birth to 2 years of age heighten the risk of mortality [Mertens, 2023]. Hence, further investigations such as ours are imperative to deepen the understanding of the causal relationship between child stunting and maternal nutrition, offering valuable insights and recommendations for policymakers, researchers, and academia.

Policymakers and **public health professionals** can use the study to design targeted intervention programs aimed at improving the nutritional status of the mother, especially during pregnancy, to reduce the incidence of child stunting. By focusing on the vulnerable POSHAN tribe, the research offers valuable insights into potential determinants that may adversely affect underserved communities, highlighting the necessity for targeted public interventions to support such populations. They might even uncover previously unrecognized factors linked to maternal nutrition or child stunting and prioritize them accordingly.

The targeted intervention programs could include community-level initiatives focused on nutrition education and counseling for pregnant mothers. The programs could incorporate guidance on proper breastfeeding practices, importance of maintaining balanced diets for both mother and the child, access to healthcare services, etc.

By examining certain variables explored in the study, such as region and age, policymakers may be able to identify the primary target demographic in need of assistance based on the findings of the study. Specifically, the research reveals that the population residing in the terai region exhibits the highest rates of child stunting, and as a mother's age rises, so does the likelihood of her child experiencing stunting between the ages of 6 and 24 months. Consequently, intervention programs could initially focus on middle-aged women in the terai region to maximize their effectiveness.

The study sheds light on additional challenges encountered by the POSHAN tribe, including food insecurity, improper defecation practices, and maternal stress, which indirectly contribute to child stunting levels. This insight may prompt policymakers or **future researchers** to delve deeper into these topics, uncovering additional health, social, and welfare concerns they engender. Targeted intervention programs addressing these issues have the potential to mitigate multiple challenges simultaneously, with maternal nutrition and child stunting being just two among them.

Limitations of the Study

While we attempted to minimize biases and inaccuracies in the study to the best of our ability, the following limitations persist:

1. **Use of cross-sectional data**: limits the ability to establish a causal relationship between mother's nutritional level and child's stunting status, especially since the cause (exposure) and effect (outcome) are measured simultaneously. A longitudinal study may help overcome this challenge.
2. **Quality of data**: The dataset used belonged to an existing study, which may have been exposed to certain biases, such as the non-response bias, which arises if women who declined to participate in the study or prematurely withdrew from it, differed systematically from those who remained, implying that if mother's with lower nutritional levels were more inclined to participate, it could be causing an overestimation of the impact of maternal nutritional status on a child's stunting status in the results. Another potential bias that the original data could be susceptible to is recall bias. This occurs when mothers are unable to accurately recall past events, leading to inaccurate responses to questions such as the frequency of consuming legumes in the past 7 days or omitting important details, for instance, relating to their breastfeeding practices. Lastly, the responses of the participants might also be influenced by social desirability bias, where women provide answers that they perceive as socially acceptable or favorable rather than accurately reflecting their experiences.

3. **Representativeness of the sample**: findings from the survey may not be directly extrapolated and generalizable for broader populations in Nepal. The survey sample predominantly focuses on specific districts of the country, thereby limiting the applicability of the results to the entire population of Nepal.
4. **Categorization of the variables**: complex variables such as household food insecurity and maternal sickness status were categorized into discrete categories for the ease of interpretation. However, this approach may have oversimplified the analysis, potentially limiting the depth of understanding and insights that could be gained from examining these variables in their entirety.
5. **Unmeasured confounding variables**: there may be additional factors influencing both the mother's nutritional status and the child's stunting status, such as the occurrence of a natural calamity or an adverse weather event in the past year, that were not accounted for in the existing dataset utilized for this study.

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Appendix

TABLE X (Variable Measurements)

Variable	Variable Name	Variable Type	How was this variable measured	Recoded

Y	stuntstat	Dummy	Readily available in dataset as *f7cstustat*	No
X1	muacavg	Continuous	Calculated as the average of 3 MUAC measurements present in the dataset. The average was calculated in excel, named *MUACAverage* and imported to STATA.	Yes (Variable calculated)
X2	HHfoodinsec	Categorical	Readily available in dataset as *f4hfiasct*	Yes (Subcategories recoded)
X3	Childsex	Dummy	Readily available in dataset as *f7chld_sex*	Yes (Subcategories flipped)
X4	treatwater	Dummy	Readily available in dataset as *f4c_4* *Question asked : Treat water before drinking it to make it safe*	Yes (Subcategories recoded)
X5	defpract	Dummy	Readily available in dataset as *f4c_7* *Question asked : Where do children < 5 yrs usually go to defecate*	Yes (Subcategories recoded)
X6	brstfeedpract	Categorical	Readily available in dataset as *f7h_4* *Question asked : In past 7 days, in an average, how many times child was breastfed per day*	No (NA dropped)
X7	HHexp	Categorical	Readily available in dataset as *f4e1_1* *Question asked : Total household expenditure (Rs.) during the last 30 days*	Yes (Subcategories recoded)
X8	motherage	Discrete	Readily available in dataset as *f6moth_age* *Question asked : Age of the respondent (mother)*	No
X9	motherstress	Dummy	Readily available in dataset as *f6b7_b* *Question asked : If respondent felt sad all the time within 30 days*	No (NA dropped)
X10	expdecision	Categorical	Readily available in dataset as *f6l_3h* *Question asked : Who normally takes the decision regarding daily household expenditures*	Yes (Subcategories recoded)
X11	mothersicknessta tus	Categorical	Calculated as the rowtotal of *f6b_p1, f6b_q1 and f6b_r1I.* Higher the score (0 to 3), higher the severity of sickness. *Questions asked,* *f6b_p1 : Ever suffered from Nausea within last 30 days* *f6b_q1 : Ever suffered from Vomiting within last 30 days*	Yes (Row totals and subcategories created)

			f6b_r1 : Ever suffered from Poor appetite within last 30 days	
X12	region	Categorical	Readily available in dataset as *region*	No
X13	legumecons	Continuous	Readily available in dataset as *f7i1_8* *Question asked : No of times consumed other legumes (chickpeas,dried peas,lima beans & soyabeans) within last 7 days*	No
X14	peanutcons	Continuous	Readily available in dataset as *f7i1_9* *Question asked : No of times consumed peanuts within last 7 days*	No
X15	milkcons	Continuous	Readily available in dataset as *f7i1_10* *Question asked : No of times consumed milk within last 7 days*	No
X16	curdcons	Continuous	Readily available in dataset as *f7i1_11* *Question asked : No of times consumed curd/whey within last 24 hours*	No
X17	proteincons	Continuous	Readily available in dataset as *f7i1_17* *Question asked : No of times consumed chicken/duck within last 24 hours*	No

Figure A (Visualizing the dependent variable Y)

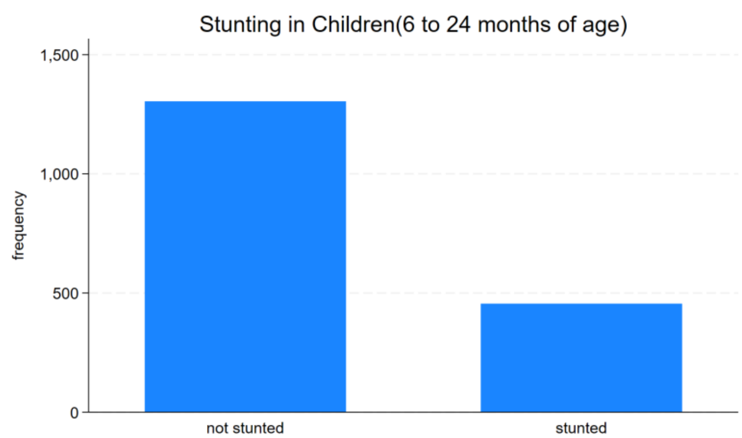

Figure B (Visualizing the key explanatory variable X1)

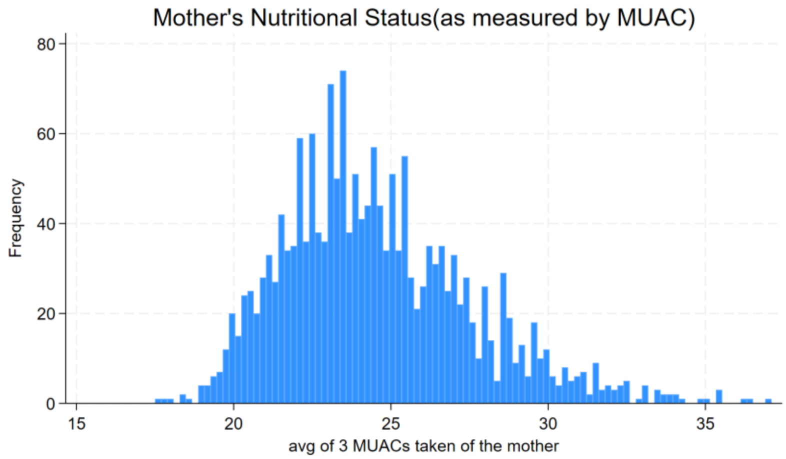

Figure C (Exploring cross-tabulation of Y and X1)

```
. tab stuntstat MUACAverage_cat

   stunting |
  status of |                 MUAC
   children | Underweig  Ideal wei  Overweigh |     Total
------------+---------------------------------+----------
not stunted |       581        591        132 |     1,304
    stunted |       266        168         21 |       455
------------+---------------------------------+----------
      Total |       847        759        153 |     1,759
```

Margins (STATA Output)

Margins without interaction term:

```
. //margins (without interaction term)
. margins, at(muacavg = (17(1)28)) atmeans

Adjusted predictions                                     Number of obs = 1,279
Model VCE: OIM

Expression: Pr(stuntstat), predict()
1._at:  muacavg          =        17
        1.HHfoodinsec    = .7756059 (mean)
        2.HHfoodinsec    = .0891321 (mean)
        3.HHfoodinsec    = .0867866 (mean)
        4.HHfoodinsec    = .0484754 (mean)
        0.childsex       =  .511337 (mean)
        1.childsex       =  .488663 (mean)
        0.treatwater     = .8600469 (mean)
        1.treatwater     = .1399531 (mean)
        0.defpract       = .4558249 (mean)
        1.defpract       = .5441751 (mean)
        0.brstfeedpract  = .0594214 (mean)
        1.brstfeedpract  = .5863956 (mean)
        2.brstfeedpract  =  .275215 (mean)
        3.brstfeedpract  = .0789679 (mean)
        1.HHexp          =  .264269 (mean)
```

```
             2.HHexp          = .4769351  (mean)
             3.HHexp          = .2587959  (mean)
             motherage        = 25.60907  (mean)
             0.motherstress   = .8858483  (mean)
             1.motherstress   = .1141517  (mean)
             1.expdecision    = .5160281  (mean)
             2.expdecision    = .3354183  (mean)
             3.expdecision    = .1485536  (mean)
             0.mothersickne~s = .8835027  (mean)
             1.mothersickne~s = .0789679  (mean)
             2.mothersickne~s = .0265833  (mean)
             3.mothersickne~s = .0109461  (mean)
             1.region         = .1118061  (mean)
             2.region         = .2314308  (mean)
             3.region         = .6567631  (mean)
             legumecons       = .7685692  (mean)
             peanutcons       = .1469898  (mean)
             milkcons         = 5.740422  (mean)
             curdcons         = .5199375  (mean)
             proteincons      = .5801407  (mean)
2._at:       muacavg          =       18
             1.HHfoodinsec    = .7756059  (mean)
             2.HHfoodinsec    = .0891321  (mean)
             3.HHfoodinsec    = .0867866  (mean)
             4.HHfoodinsec    = .0484754  (mean)
             0.childsex       =  .511337  (mean)
             1.childsex       =  .488663  (mean)
             0.treatwater     = .8600469  (mean)
             1.treatwater     = .1399531  (mean)
             0.defpract       = .4558249  (mean)
             1.defpract       = .5441751  (mean)
             0.brstfeedpract  = .0594214  (mean)
             1.brstfeedpract  = .5863956  (mean)
             2.brstfeedpract  =  .275215  (mean)
             3.brstfeedpract  = .0789679  (mean)
             1.HHexp          =  .264269  (mean)
             2.HHexp          = .4769351  (mean)
             3.HHexp          = .2587959  (mean)
             motherage        = 25.60907  (mean)
             0.motherstress   = .8858483  (mean)
             1.motherstress   = .1141517  (mean)
             1.expdecision    = .5160281  (mean)
             2.expdecision    = .3354183  (mean)
             3.expdecision    = .1485536  (mean)
             0.mothersickne~s = .8835027  (mean)
             1.mothersickne~s = .0789679  (mean)
             2.mothersickne~s = .0265833  (mean)
             3.mothersickne~s = .0109461  (mean)
             1.region         = .1118061  (mean)
             2.region         = .2314308  (mean)
             3.region         = .6567631  (mean)
             legumecons       = .7685692  (mean)
             peanutcons       = .1469898  (mean)
             milkcons         = 5.740422  (mean)
             curdcons         = .5199375  (mean)
             proteincons      = .5801407  (mean)
3._at:       muacavg          =       19
             1.HHfoodinsec    = .7756059  (mean)
             2.HHfoodinsec    = .0891321  (mean)
             3.HHfoodinsec    = .0867866  (mean)
             4.HHfoodinsec    = .0484754  (mean)
             0.childsex       =  .511337  (mean)
             1.childsex       =  .488663  (mean)
             0.treatwater     = .8600469  (mean)
             1.treatwater     = .1399531  (mean)
             0.defpract       = .4558249  (mean)
             1.defpract       = .5441751  (mean)
             0.brstfeedpract  = .0594214  (mean)
             1.brstfeedpract  = .5863956  (mean)
             2.brstfeedpract  =  .275215  (mean)
             3.brstfeedpract  = .0789679  (mean)
```

```
             1.HHexp           =  .264269  (mean)
             2.HHexp           = .4769351  (mean)
             3.HHexp           = .2587959  (mean)
             motherage         = 25.60907  (mean)
             0.motherstress    = .8858483  (mean)
             1.motherstress    = .1141517  (mean)
             1.expdecision     = .5160281  (mean)
             2.expdecision     = .3354183  (mean)
             3.expdecision     = .1485536  (mean)
             0.mothersickne~s  = .8835027  (mean)
             1.mothersickne~s  = .0789679  (mean)
             2.mothersickne~s  = .0265833  (mean)
             3.mothersickne~s  = .0109461  (mean)
             1.region          = .1118061  (mean)
             2.region          = .2314308  (mean)
             3.region          = .6567631  (mean)
             legumecons        = .7685692  (mean)
             peanutcons        = .1469898  (mean)
             milkcons          = 5.740422  (mean)
             curdcons          = .5199375  (mean)
             proteincons       = .5801407  (mean)
4._at:       muacavg           =       20
             1.HHfoodinsec     = .7756059  (mean)
             2.HHfoodinsec     = .0891321  (mean)
             3.HHfoodinsec     = .0867866  (mean)
             4.HHfoodinsec     = .0484754  (mean)
             0.childsex        =  .511337  (mean)
             1.childsex        =  .488663  (mean)
             0.treatwater      = .8600469  (mean)
             1.treatwater      = .1399531  (mean)
             0.defpract        = .4558249  (mean)
             1.defpract        = .5441751  (mean)
             0.brstfeedpract   = .0594214  (mean)
             1.brstfeedpract   = .5863956  (mean)
             2.brstfeedpract   =  .275215  (mean)
             3.brstfeedpract   = .0789679  (mean)
             1.HHexp           =  .264269  (mean)
             2.HHexp           = .4769351  (mean)
             3.HHexp           = .2587959  (mean)
             motherage         = 25.60907  (mean)
             0.motherstress    = .8858483  (mean)
             1.motherstress    = .1141517  (mean)
             1.expdecision     = .5160281  (mean)
             2.expdecision     = .3354183  (mean)
             3.expdecision     = .1485536  (mean)
             0.mothersickne~s  = .8835027  (mean)
             1.mothersickne~s  = .0789679  (mean)
             2.mothersickne~s  = .0265833  (mean)
             3.mothersickne~s  = .0109461  (mean)
             1.region          = .1118061  (mean)
             2.region          = .2314308  (mean)
             3.region          = .6567631  (mean)
             legumecons        = .7685692  (mean)
             peanutcons        = .1469898  (mean)
             milkcons          = 5.740422  (mean)
             curdcons          = .5199375  (mean)
             proteincons       = .5801407  (mean)
5._at:       muacavg           =       21
             1.HHfoodinsec     = .7756059  (mean)
             2.HHfoodinsec     = .0891321  (mean)
             3.HHfoodinsec     = .0867866  (mean)
             4.HHfoodinsec     = .0484754  (mean)
             0.childsex        =  .511337  (mean)
             1.childsex        =  .488663  (mean)
             0.treatwater      = .8600469  (mean)
             1.treatwater      = .1399531  (mean)
             0.defpract        = .4558249  (mean)
             1.defpract        = .5441751  (mean)
             0.brstfeedpract   = .0594214  (mean)
             1.brstfeedpract   = .5863956  (mean)
             2.brstfeedpract   =  .275215  (mean)
```

```
               3.brstfeedpract  = .0789679  (mean)
               1.HHexp          =  .264269  (mean)
               2.HHexp          = .4769351  (mean)
               3.HHexp          = .2587959  (mean)
               motherage        = 25.60907  (mean)
               0.motherstress   = .8858483  (mean)
               1.motherstress   = .1141517  (mean)
               1.expdecision    = .5160281  (mean)
               2.expdecision    = .3354183  (mean)
               3.expdecision    = .1485536  (mean)
               0.mothersickne~s = .8835027  (mean)
               1.mothersickne~s = .0789679  (mean)
               2.mothersickne~s = .0265833  (mean)
               3.mothersickne~s = .0109461  (mean)
               1.region         = .1118061  (mean)
               2.region         = .2314308  (mean)
               3.region         = .6567631  (mean)
               legumecons       = .7685692  (mean)
               peanutcons       = .1469898  (mean)
               milkcons         = 5.740422  (mean)
               curdcons         = .5199375  (mean)
               proteincons      = .5801407  (mean)
       6._at:  muacavg          =       22
               1.HHfoodinsec    = .7756059  (mean)
               2.HHfoodinsec    = .0891321  (mean)
               3.HHfoodinsec    = .0867866  (mean)
               4.HHfoodinsec    = .0484754  (mean)
               0.childsex       =  .511337  (mean)
               1.childsex       =  .488663  (mean)
               0.treatwater     = .8600469  (mean)
               1.treatwater     = .1399531  (mean)
               0.defpract       = .4558249  (mean)
               1.defpract       = .5441751  (mean)
               0.brstfeedpract  = .0594214  (mean)
               1.brstfeedpract  = .5863956  (mean)
               2.brstfeedpract  =  .275215  (mean)
               3.brstfeedpract  = .0789679  (mean)
               1.HHexp          =  .264269  (mean)
               2.HHexp          = .4769351  (mean)
               3.HHexp          = .2587959  (mean)
               motherage        = 25.60907  (mean)
               0.motherstress   = .8858483  (mean)
               1.motherstress   = .1141517  (mean)
               1.expdecision    = .5160281  (mean)
               2.expdecision    = .3354183  (mean)
               3.expdecision    = .1485536  (mean)
               0.mothersickne~s = .8835027  (mean)
               1.mothersickne~s = .0789679  (mean)
               2.mothersickne~s = .0265833  (mean)
               3.mothersickne~s = .0109461  (mean)
               1.region         = .1118061  (mean)
               2.region         = .2314308  (mean)
               3.region         = .6567631  (mean)
               legumecons       = .7685692  (mean)
               peanutcons       = .1469898  (mean)
               milkcons         = 5.740422  (mean)
               curdcons         = .5199375  (mean)
               proteincons      = .5801407  (mean)
       7._at:  muacavg          =       23
               1.HHfoodinsec    = .7756059  (mean)
               2.HHfoodinsec    = .0891321  (mean)
               3.HHfoodinsec    = .0867866  (mean)
               4.HHfoodinsec    = .0484754  (mean)
               0.childsex       =  .511337  (mean)
               1.childsex       =  .488663  (mean)
               0.treatwater     = .8600469  (mean)
               1.treatwater     = .1399531  (mean)
               0.defpract       = .4558249  (mean)
               1.defpract       = .5441751  (mean)
               0.brstfeedpract  = .0594214  (mean)
               1.brstfeedpract  = .5863956  (mean)
```

```
              2.brstfeedpract  =   .275215  (mean)
              3.brstfeedpract  = .0789679  (mean)
              1.HHexp          =   .264269  (mean)
              2.HHexp          = .4769351  (mean)
              3.HHexp          = .2587959  (mean)
              motherage        = 25.60907  (mean)
              0.motherstress   = .8858483  (mean)
              1.motherstress   = .1141517  (mean)
              1.expdecision    = .5160281  (mean)
              2.expdecision    = .3354183  (mean)
              3.expdecision    = .1485536  (mean)
              0.mothersickne~s = .8835027  (mean)
              1.mothersickne~s = .0789679  (mean)
              2.mothersickne~s = .0265833  (mean)
              3.mothersickne~s = .0109461  (mean)
              1.region         = .1118061  (mean)
              2.region         = .2314308  (mean)
              3.region         = .6567631  (mean)
              legumecons       = .7685692  (mean)
              peanutcons       = .1469898  (mean)
              milkcons         = 5.740422  (mean)
              curdcons         = .5199375  (mean)
              proteincons      = .5801407  (mean)
8._at:        muacavg          =        24
              1.HHfoodinsec    = .7756059  (mean)
              2.HHfoodinsec    = .0891321  (mean)
              3.HHfoodinsec    = .0867866  (mean)
              4.HHfoodinsec    = .0484754  (mean)
              0.childsex       =   .511337  (mean)
              1.childsex       =   .488663  (mean)
              0.treatwater     = .8600469  (mean)
              1.treatwater     = .1399531  (mean)
              0.defpract       = .4558249  (mean)
              1.defpract       = .5441751  (mean)
              0.brstfeedpract  = .0594214  (mean)
              1.brstfeedpract  = .5863956  (mean)
              2.brstfeedpract  =   .275215  (mean)
              3.brstfeedpract  = .0789679  (mean)
              1.HHexp          =   .264269  (mean)
              2.HHexp          = .4769351  (mean)
              3.HHexp          = .2587959  (mean)
              motherage        = 25.60907  (mean)
              0.motherstress   = .8858483  (mean)
              1.motherstress   = .1141517  (mean)
              1.expdecision    = .5160281  (mean)
              2.expdecision    = .3354183  (mean)
              3.expdecision    = .1485536  (mean)
              0.mothersickne~s = .8835027  (mean)
              1.mothersickne~s = .0789679  (mean)
              2.mothersickne~s = .0265833  (mean)
              3.mothersickne~s = .0109461  (mean)
              1.region         = .1118061  (mean)
              2.region         = .2314308  (mean)
              3.region         = .6567631  (mean)
              legumecons       = .7685692  (mean)
              peanutcons       = .1469898  (mean)
              milkcons         = 5.740422  (mean)
              curdcons         = .5199375  (mean)
              proteincons      = .5801407  (mean)
9._at:        muacavg          =        25
              1.HHfoodinsec    = .7756059  (mean)
              2.HHfoodinsec    = .0891321  (mean)
              3.HHfoodinsec    = .0867866  (mean)
              4.HHfoodinsec    = .0484754  (mean)
              0.childsex       =   .511337  (mean)
              1.childsex       =   .488663  (mean)
              0.treatwater     = .8600469  (mean)
              1.treatwater     = .1399531  (mean)
              0.defpract       = .4558249  (mean)
              1.defpract       = .5441751  (mean)
              0.brstfeedpract  = .0594214  (mean)
```

```
               1.brstfeedpract  = .5863956 (mean)
               2.brstfeedpract  =  .275215 (mean)
               3.brstfeedpract  = .0789679 (mean)
               1.HHexp          =  .264269 (mean)
               2.HHexp          = .4769351 (mean)
               3.HHexp          = .2587959 (mean)
               motherage        = 25.60907 (mean)
               0.motherstress   = .8858483 (mean)
               1.motherstress   = .1141517 (mean)
               1.expdecision    = .5160281 (mean)
               2.expdecision    = .3354183 (mean)
               3.expdecision    = .1485536 (mean)
               0.mothersickne~s = .8835027 (mean)
               1.mothersickne~s = .0789679 (mean)
               2.mothersickne~s = .0265833 (mean)
               3.mothersickne~s = .0109461 (mean)
               1.region         = .1118061 (mean)
               2.region         = .2314308 (mean)
               3.region         = .6567631 (mean)
               legumecons       = .7685692 (mean)
               peanutcons       = .1469898 (mean)
               milkcons         = 5.740422 (mean)
               curdcons         = .5199375 (mean)
               proteincons      = .5801407 (mean)
       10._at: muacavg          =       26
               1.HHfoodinsec    = .7756059 (mean)
               2.HHfoodinsec    = .0891321 (mean)
               3.HHfoodinsec    = .0867866 (mean)
               4.HHfoodinsec    = .0484754 (mean)
               0.childsex       =  .511337 (mean)
               1.childsex       =  .488663 (mean)
               0.treatwater     = .8600469 (mean)
               1.treatwater     = .1399531 (mean)
               0.defpract       = .4558249 (mean)
               1.defpract       = .5441751 (mean)
               0.brstfeedpract  = .0594214 (mean)
               1.brstfeedpract  = .5863956 (mean)
               2.brstfeedpract  =  .275215 (mean)
               3.brstfeedpract  = .0789679 (mean)
               1.HHexp          =  .264269 (mean)
               2.HHexp          = .4769351 (mean)
               3.HHexp          = .2587959 (mean)
               motherage        = 25.60907 (mean)
               0.motherstress   = .8858483 (mean)
               1.motherstress   = .1141517 (mean)
               1.expdecision    = .5160281 (mean)
               2.expdecision    = .3354183 (mean)
               3.expdecision    = .1485536 (mean)
               0.mothersickne~s = .8835027 (mean)
               1.mothersickne~s = .0789679 (mean)
               2.mothersickne~s = .0265833 (mean)
               3.mothersickne~s = .0109461 (mean)
               1.region         = .1118061 (mean)
               2.region         = .2314308 (mean)
               3.region         = .6567631 (mean)
               legumecons       = .7685692 (mean)
               peanutcons       = .1469898 (mean)
               milkcons         = 5.740422 (mean)
               curdcons         = .5199375 (mean)
               proteincons      = .5801407 (mean)
       11._at: muacavg          =       27
               1.HHfoodinsec    = .7756059 (mean)
               2.HHfoodinsec    = .0891321 (mean)
               3.HHfoodinsec    = .0867866 (mean)
               4.HHfoodinsec    = .0484754 (mean)
               0.childsex       =  .511337 (mean)
               1.childsex       =  .488663 (mean)
               0.treatwater     = .8600469 (mean)
               1.treatwater     = .1399531 (mean)
               0.defpract       = .4558249 (mean)
               1.defpract       = .5441751 (mean)
```

```
        0.brstfeedpract  = .0594214 (mean)
        1.brstfeedpract  = .5863956 (mean)
        2.brstfeedpract  =  .275215 (mean)
        3.brstfeedpract  = .0789679 (mean)
        1.HHexp          =  .264269 (mean)
        2.HHexp          = .4769351 (mean)
        3.HHexp          = .2587959 (mean)
        motherage        = 25.60907 (mean)
        0.motherstress   = .8858483 (mean)
        1.motherstress   = .1141517 (mean)
        1.expdecision    = .5160281 (mean)
        2.expdecision    = .3354183 (mean)
        3.expdecision    = .1485536 (mean)
        0.mothersickne~s = .8835027 (mean)
        1.mothersickne~s = .0789679 (mean)
        2.mothersickne~s = .0265833 (mean)
        3.mothersickne~s = .0109461 (mean)
        1.region         = .1118061 (mean)
        2.region         = .2314308 (mean)
        3.region         = .6567631 (mean)
        legumecons       = .7685692 (mean)
        peanutcons       = .1469898 (mean)
        milkcons         = 5.740422 (mean)
        curdcons         = .5199375 (mean)
        proteincons      = .5801407 (mean)
12._at: muacavg          =       28
        1.HHfoodinsec    = .7756059 (mean)
        2.HHfoodinsec    = .0891321 (mean)
        3.HHfoodinsec    = .0867866 (mean)
        4.HHfoodinsec    = .0484754 (mean)
        0.childsex       =  .511337 (mean)
        1.childsex       =  .488663 (mean)
        0.treatwater     = .8600469 (mean)
        1.treatwater     = .1399531 (mean)
        0.defpract       = .4558249 (mean)
        1.defpract       = .5441751 (mean)
        0.brstfeedpract  = .0594214 (mean)
        1.brstfeedpract  = .5863956 (mean)
        2.brstfeedpract  =  .275215 (mean)
        3.brstfeedpract  = .0789679 (mean)
        1.HHexp          =  .264269 (mean)
        2.HHexp          = .4769351 (mean)
        3.HHexp          = .2587959 (mean)
        motherage        = 25.60907 (mean)
        0.motherstress   = .8858483 (mean)
        1.motherstress   = .1141517 (mean)
        1.expdecision    = .5160281 (mean)
        2.expdecision    = .3354183 (mean)
        3.expdecision    = .1485536 (mean)
        0.mothersickne~s = .8835027 (mean)
        1.mothersickne~s = .0789679 (mean)
        2.mothersickne~s = .0265833 (mean)
        3.mothersickne~s = .0109461 (mean)
        1.region         = .1118061 (mean)
        2.region         = .2314308 (mean)
        3.region         = .6567631 (mean)
        legumecons       = .7685692 (mean)
        peanutcons       = .1469898 (mean)
        milkcons         = 5.740422 (mean)
        curdcons         = .5199375 (mean)
        proteincons      = .5801407 (mean)
```

_at	Margin	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
1	.4512975	.0476418	9.47	0.000	.3579214	.5446737
2	.4226208	.0410655	10.29	0.000	.3421339	.5031077
3	.3944564	.0345959	11.40	0.000	.3266497	.462263
4	.3669759	.0284334	12.91	0.000	.3112475	.4227042

```
          5  |   .3403339   .0228204    14.91   0.000     .2956067     .385061
          6  |   .3146646   .0180826    17.40   0.000     .2792234    .3501058
          7  |   .2900801   .0146746    19.77   0.000     .2613184    .3188417
          8  |   .2666689   .0130781    20.39   0.000     .2410363    .2923015
          9  |   .2444964   .0133393    18.33   0.000     .2183519     .270641
         10  |   .2236054   .0148383    15.07   0.000     .1945229    .2526878
         11  |   .2040173   .0168323    12.12   0.000     .1710267     .237008
         12  |   .1857347   .0188468     9.85   0.000     .1487957    .2226738
------------------------------------------------------------------------------
```

Margins with interaction term:

```
. //margins (with interaction term)
. margins, at(muacavg = (17(1)28)) atmeans

Adjusted predictions                                    Number of obs = 1,279
Model VCE: OIM

Expression: Pr(stuntstat), predict()
1._at:  muacavg          =       17
        1.HHfoodinsec    = .7756059 (mean)
        2.HHfoodinsec    = .0891321 (mean)
        3.HHfoodinsec    = .0867866 (mean)
        4.HHfoodinsec    = .0484754 (mean)
        0.childsex       =  .511337 (mean)
        1.childsex       =  .488663 (mean)
        0.treatwater     = .8600469 (mean)
        1.treatwater     = .1399531 (mean)
        0.defpract       = .4558249 (mean)
        1.defpract       = .5441751 (mean)
        0.brstfeedpract  = .0594214 (mean)
        1.brstfeedpract  = .5863956 (mean)
        2.brstfeedpract  =  .275215 (mean)
        3.brstfeedpract  = .0789679 (mean)
        1.HHexp          =  .264269 (mean)
        2.HHexp          = .4769351 (mean)
        3.HHexp          = .2587959 (mean)
        motherage        = 25.60907 (mean)
        0.motherstress   = .8858483 (mean)
        1.motherstress   = .1141517 (mean)
        1.expdecision    = .5160281 (mean)
        2.expdecision    = .3354183 (mean)
        3.expdecision    = .1485536 (mean)
        0.mothersickne~s = .8835027 (mean)
        1.mothersickne~s = .0789679 (mean)
        2.mothersickne~s = .0265833 (mean)
        3.mothersickne~s = .0109461 (mean)
        1.region         = .1118061 (mean)
        2.region         = .2314308 (mean)
        3.region         = .6567631 (mean)
        legumecons       = .7685692 (mean)
        peanutcons       = .1469898 (mean)
        milkcons         = 5.740422 (mean)
        curdcons         = .5199375 (mean)
        proteincons      = .5801407 (mean)
2._at:  muacavg          =       18
        1.HHfoodinsec    = .7756059 (mean)
        2.HHfoodinsec    = .0891321 (mean)
        3.HHfoodinsec    = .0867866 (mean)
        4.HHfoodinsec    = .0484754 (mean)
        0.childsex       =  .511337 (mean)
        1.childsex       =  .488663 (mean)
        0.treatwater     = .8600469 (mean)
        1.treatwater     = .1399531 (mean)
        0.defpract       = .4558249 (mean)
        1.defpract       = .5441751 (mean)
        0.brstfeedpract  = .0594214 (mean)
        1.brstfeedpract  = .5863956 (mean)
        2.brstfeedpract  =  .275215 (mean)
```

```
                3.brstfeedpract  = .0789679 (mean)
                1.HHexp          =  .264269 (mean)
                2.HHexp          = .4769351 (mean)
                3.HHexp          = .2587959 (mean)
                motherage        = 25.60907 (mean)
                0.motherstress   = .8858483 (mean)
                1.motherstress   = .1141517 (mean)
                1.expdecision    = .5160281 (mean)
                2.expdecision    = .3354183 (mean)
                3.expdecision    = .1485536 (mean)
                0.mothersickne~s = .8835027 (mean)
                1.mothersickne~s = .0789679 (mean)
                2.mothersickne~s = .0265833 (mean)
                3.mothersickne~s = .0109461 (mean)
                1.region         = .1118061 (mean)
                2.region         = .2314308 (mean)
                3.region         = .6567631 (mean)
                legumecons       = .7685692 (mean)
                peanutcons       = .1469898 (mean)
                milkcons         = 5.740422 (mean)
                curdcons         = .5199375 (mean)
                proteincons      = .5801407 (mean)
        3._at:  muacavg          =       19
                1.HHfoodinsec    = .7756059 (mean)
                2.HHfoodinsec    = .0891321 (mean)
                3.HHfoodinsec    = .0867866 (mean)
                4.HHfoodinsec    = .0484754 (mean)
                0.childsex       =  .511337 (mean)
                1.childsex       =  .488663 (mean)
                0.treatwater     = .8600469 (mean)
                1.treatwater     = .1399531 (mean)
                0.defpract       = .4558249 (mean)
                1.defpract       = .5441751 (mean)
                0.brstfeedpract  = .0594214 (mean)
                1.brstfeedpract  = .5863956 (mean)
                2.brstfeedpract  =  .275215 (mean)
                3.brstfeedpract  = .0789679 (mean)
                1.HHexp          =  .264269 (mean)
                2.HHexp          = .4769351 (mean)
                3.HHexp          = .2587959 (mean)
                motherage        = 25.60907 (mean)
                0.motherstress   = .8858483 (mean)
                1.motherstress   = .1141517 (mean)
                1.expdecision    = .5160281 (mean)
                2.expdecision    = .3354183 (mean)
                3.expdecision    = .1485536 (mean)
                0.mothersickne~s = .8835027 (mean)
                1.mothersickne~s = .0789679 (mean)
                2.mothersickne~s = .0265833 (mean)
                3.mothersickne~s = .0109461 (mean)
                1.region         = .1118061 (mean)
                2.region         = .2314308 (mean)
                3.region         = .6567631 (mean)
                legumecons       = .7685692 (mean)
                peanutcons       = .1469898 (mean)
                milkcons         = 5.740422 (mean)
                curdcons         = .5199375 (mean)
                proteincons      = .5801407 (mean)
        4._at:  muacavg          =       20
                1.HHfoodinsec    = .7756059 (mean)
                2.HHfoodinsec    = .0891321 (mean)
                3.HHfoodinsec    = .0867866 (mean)
                4.HHfoodinsec    = .0484754 (mean)
                0.childsex       =  .511337 (mean)
                1.childsex       =  .488663 (mean)
                0.treatwater     = .8600469 (mean)
                1.treatwater     = .1399531 (mean)
                0.defpract       = .4558249 (mean)
                1.defpract       = .5441751 (mean)
                0.brstfeedpract  = .0594214 (mean)
                1.brstfeedpract  = .5863956 (mean)
```

```
         2.brstfeedpract  =   .275215  (mean)
         3.brstfeedpract  = .0789679  (mean)
         1.HHexp          =   .264269  (mean)
         2.HHexp          = .4769351  (mean)
         3.HHexp          = .2587959  (mean)
         motherage        = 25.60907  (mean)
         0.motherstress   = .8858483  (mean)
         1.motherstress   = .1141517  (mean)
         1.expdecision    = .5160281  (mean)
         2.expdecision    = .3354183  (mean)
         3.expdecision    = .1485536  (mean)
         0.mothersickne~s = .8835027  (mean)
         1.mothersickne~s = .0789679  (mean)
         2.mothersickne~s = .0265833  (mean)
         3.mothersickne~s = .0109461  (mean)
         1.region         = .1118061  (mean)
         2.region         = .2314308  (mean)
         3.region         = .6567631  (mean)
         legumecons       = .7685692  (mean)
         peanutcons       = .1469898  (mean)
         milkcons         = 5.740422  (mean)
         curdcons         = .5199375  (mean)
         proteincons      = .5801407  (mean)
5._at:   muacavg          =        21
         1.HHfoodinsec    = .7756059  (mean)
         2.HHfoodinsec    = .0891321  (mean)
         3.HHfoodinsec    = .0867866  (mean)
         4.HHfoodinsec    = .0484754  (mean)
         0.childsex       =   .511337  (mean)
         1.childsex       =   .488663  (mean)
         0.treatwater     = .8600469  (mean)
         1.treatwater     = .1399531  (mean)
         0.defpract       = .4558249  (mean)
         1.defpract       = .5441751  (mean)
         0.brstfeedpract  = .0594214  (mean)
         1.brstfeedpract  = .5863956  (mean)
         2.brstfeedpract  =   .275215  (mean)
         3.brstfeedpract  = .0789679  (mean)
         1.HHexp          =   .264269  (mean)
         2.HHexp          = .4769351  (mean)
         3.HHexp          = .2587959  (mean)
         motherage        = 25.60907  (mean)
         0.motherstress   = .8858483  (mean)
         1.motherstress   = .1141517  (mean)
         1.expdecision    = .5160281  (mean)
         2.expdecision    = .3354183  (mean)
         3.expdecision    = .1485536  (mean)
         0.mothersickne~s = .8835027  (mean)
         1.mothersickne~s = .0789679  (mean)
         2.mothersickne~s = .0265833  (mean)
         3.mothersickne~s = .0109461  (mean)
         1.region         = .1118061  (mean)
         2.region         = .2314308  (mean)
         3.region         = .6567631  (mean)
         legumecons       = .7685692  (mean)
         peanutcons       = .1469898  (mean)
         milkcons         = 5.740422  (mean)
         curdcons         = .5199375  (mean)
         proteincons      = .5801407  (mean)
6._at:   muacavg          =        22
         1.HHfoodinsec    = .7756059  (mean)
         2.HHfoodinsec    = .0891321  (mean)
         3.HHfoodinsec    = .0867866  (mean)
         4.HHfoodinsec    = .0484754  (mean)
         0.childsex       =   .511337  (mean)
         1.childsex       =   .488663  (mean)
         0.treatwater     = .8600469  (mean)
         1.treatwater     = .1399531  (mean)
         0.defpract       = .4558249  (mean)
         1.defpract       = .5441751  (mean)
         0.brstfeedpract  = .0594214  (mean)
```

```
         1.brstfeedpract  = .5863956 (mean)
         2.brstfeedpract  =  .275215 (mean)
         3.brstfeedpract  = .0789679 (mean)
         1.HHexp          =  .264269 (mean)
         2.HHexp          = .4769351 (mean)
         3.HHexp          = .2587959 (mean)
         motherage        = 25.60907 (mean)
         0.motherstress   = .8858483 (mean)
         1.motherstress   = .1141517 (mean)
         1.expdecision    = .5160281 (mean)
         2.expdecision    = .3354183 (mean)
         3.expdecision    = .1485536 (mean)
         0.mothersickne~s = .8835027 (mean)
         1.mothersickne~s = .0789679 (mean)
         2.mothersickne~s = .0265833 (mean)
         3.mothersickne~s = .0109461 (mean)
         1.region         = .1118061 (mean)
         2.region         = .2314308 (mean)
         3.region         = .6567631 (mean)
         legumecons       = .7685692 (mean)
         peanutcons       = .1469898 (mean)
         milkcons         = 5.740422 (mean)
         curdcons         = .5199375 (mean)
         proteincons      = .5801407 (mean)
7._at:   muacavg          =       23
         1.HHfoodinsec    = .7756059 (mean)
         2.HHfoodinsec    = .0891321 (mean)
         3.HHfoodinsec    = .0867866 (mean)
         4.HHfoodinsec    = .0484754 (mean)
         0.childsex       =  .511337 (mean)
         1.childsex       =  .488663 (mean)
         0.treatwater     = .8600469 (mean)
         1.treatwater     = .1399531 (mean)
         0.defpract       = .4558249 (mean)
         1.defpract       = .5441751 (mean)
         0.brstfeedpract  = .0594214 (mean)
         1.brstfeedpract  = .5863956 (mean)
         2.brstfeedpract  =  .275215 (mean)
         3.brstfeedpract  = .0789679 (mean)
         1.HHexp          =  .264269 (mean)
         2.HHexp          = .4769351 (mean)
         3.HHexp          = .2587959 (mean)
         motherage        = 25.60907 (mean)
         0.motherstress   = .8858483 (mean)
         1.motherstress   = .1141517 (mean)
         1.expdecision    = .5160281 (mean)
         2.expdecision    = .3354183 (mean)
         3.expdecision    = .1485536 (mean)
         0.mothersickne~s = .8835027 (mean)
         1.mothersickne~s = .0789679 (mean)
         2.mothersickne~s = .0265833 (mean)
         3.mothersickne~s = .0109461 (mean)
         1.region         = .1118061 (mean)
         2.region         = .2314308 (mean)
         3.region         = .6567631 (mean)
         legumecons       = .7685692 (mean)
         peanutcons       = .1469898 (mean)
         milkcons         = 5.740422 (mean)
         curdcons         = .5199375 (mean)
         proteincons      = .5801407 (mean)
8._at:   muacavg          =       24
         1.HHfoodinsec    = .7756059 (mean)
         2.HHfoodinsec    = .0891321 (mean)
         3.HHfoodinsec    = .0867866 (mean)
         4.HHfoodinsec    = .0484754 (mean)
         0.childsex       =  .511337 (mean)
         1.childsex       =  .488663 (mean)
         0.treatwater     = .8600469 (mean)
         1.treatwater     = .1399531 (mean)
         0.defpract       = .4558249 (mean)
         1.defpract       = .5441751 (mean)
```

```
          0.brstfeedpract  = .0594214 (mean)
          1.brstfeedpract  = .5863956 (mean)
          2.brstfeedpract  =  .275215 (mean)
          3.brstfeedpract  = .0789679 (mean)
          1.HHexp          =  .264269 (mean)
          2.HHexp          = .4769351 (mean)
          3.HHexp          = .2587959 (mean)
          motherage        = 25.60907 (mean)
          0.motherstress   = .8858483 (mean)
          1.motherstress   = .1141517 (mean)
          1.expdecision    = .5160281 (mean)
          2.expdecision    = .3354183 (mean)
          3.expdecision    = .1485536 (mean)
          0.mothersickne~s = .8835027 (mean)
          1.mothersickne~s = .0789679 (mean)
          2.mothersickne~s = .0265833 (mean)
          3.mothersickne~s = .0109461 (mean)
          1.region         = .1118061 (mean)
          2.region         = .2314308 (mean)
          3.region         = .6567631 (mean)
          legumecons       = .7685692 (mean)
          peanutcons       = .1469898 (mean)
          milkcons         = 5.740422 (mean)
          curdcons         = .5199375 (mean)
          proteincons      = .5801407 (mean)
9._at:    muacavg          =       25
          1.HHfoodinsec    = .7756059 (mean)
          2.HHfoodinsec    = .0891321 (mean)
          3.HHfoodinsec    = .0867866 (mean)
          4.HHfoodinsec    = .0484754 (mean)
          0.childsex       =  .511337 (mean)
          1.childsex       =  .488663 (mean)
          0.treatwater     = .8600469 (mean)
          1.treatwater     = .1399531 (mean)
          0.defpract       = .4558249 (mean)
          1.defpract       = .5441751 (mean)
          0.brstfeedpract  = .0594214 (mean)
          1.brstfeedpract  = .5863956 (mean)
          2.brstfeedpract  =  .275215 (mean)
          3.brstfeedpract  = .0789679 (mean)
          1.HHexp          =  .264269 (mean)
          2.HHexp          = .4769351 (mean)
          3.HHexp          = .2587959 (mean)
          motherage        = 25.60907 (mean)
          0.motherstress   = .8858483 (mean)
          1.motherstress   = .1141517 (mean)
          1.expdecision    = .5160281 (mean)
          2.expdecision    = .3354183 (mean)
          3.expdecision    = .1485536 (mean)
          0.mothersickne~s = .8835027 (mean)
          1.mothersickne~s = .0789679 (mean)
          2.mothersickne~s = .0265833 (mean)
          3.mothersickne~s = .0109461 (mean)
          1.region         = .1118061 (mean)
          2.region         = .2314308 (mean)
          3.region         = .6567631 (mean)
          legumecons       = .7685692 (mean)
          peanutcons       = .1469898 (mean)
          milkcons         = 5.740422 (mean)
          curdcons         = .5199375 (mean)
          proteincons      = .5801407 (mean)
10._at:   muacavg          =       26
          1.HHfoodinsec    = .7756059 (mean)
          2.HHfoodinsec    = .0891321 (mean)
          3.HHfoodinsec    = .0867866 (mean)
          4.HHfoodinsec    = .0484754 (mean)
          0.childsex       =  .511337 (mean)
          1.childsex       =  .488663 (mean)
          0.treatwater     = .8600469 (mean)
          1.treatwater     = .1399531 (mean)
          0.defpract       = .4558249 (mean)
```

```
                1.defpract        = .5441751  (mean)
                0.brstfeedpract   = .0594214  (mean)
                1.brstfeedpract   = .5863956  (mean)
                2.brstfeedpract   =  .275215  (mean)
                3.brstfeedpract   = .0789679  (mean)
                1.HHexp           =  .264269  (mean)
                2.HHexp           = .4769351  (mean)
                3.HHexp           = .2587959  (mean)
                motherage         = 25.60907  (mean)
                0.motherstress    = .8858483  (mean)
                1.motherstress    = .1141517  (mean)
                1.expdecision     = .5160281  (mean)
                2.expdecision     = .3354183  (mean)
                3.expdecision     = .1485536  (mean)
                0.mothersickne~s = .8835027  (mean)
                1.mothersickne~s = .0789679  (mean)
                2.mothersickne~s = .0265833  (mean)
                3.mothersickne~s = .0109461  (mean)
                1.region          = .1118061  (mean)
                2.region          = .2314308  (mean)
                3.region          = .6567631  (mean)
                legumecons        = .7685692  (mean)
                peanutcons        = .1469898  (mean)
                milkcons          = 5.740422  (mean)
                curdcons          = .5199375  (mean)
                proteincons       = .5801407  (mean)
        11._at: muacavg           =       27
                1.HHfoodinsec     = .7756059  (mean)
                2.HHfoodinsec     = .0891321  (mean)
                3.HHfoodinsec     = .0867866  (mean)
                4.HHfoodinsec     = .0484754  (mean)
                0.childsex        =  .511337  (mean)
                1.childsex        =  .488663  (mean)
                0.treatwater      = .8600469  (mean)
                1.treatwater      = .1399531  (mean)
                0.defpract        = .4558249  (mean)
                1.defpract        = .5441751  (mean)
                0.brstfeedpract   = .0594214  (mean)
                1.brstfeedpract   = .5863956  (mean)
                2.brstfeedpract   =  .275215  (mean)
                3.brstfeedpract   = .0789679  (mean)
                1.HHexp           =  .264269  (mean)
                2.HHexp           = .4769351  (mean)
                3.HHexp           = .2587959  (mean)
                motherage         = 25.60907  (mean)
                0.motherstress    = .8858483  (mean)
                1.motherstress    = .1141517  (mean)
                1.expdecision     = .5160281  (mean)
                2.expdecision     = .3354183  (mean)
                3.expdecision     = .1485536  (mean)
                0.mothersickne~s = .8835027  (mean)
                1.mothersickne~s = .0789679  (mean)
                2.mothersickne~s = .0265833  (mean)
                3.mothersickne~s = .0109461  (mean)
                1.region          = .1118061  (mean)
                2.region          = .2314308  (mean)
                3.region          = .6567631  (mean)
                legumecons        = .7685692  (mean)
                peanutcons        = .1469898  (mean)
                milkcons          = 5.740422  (mean)
                curdcons          = .5199375  (mean)
                proteincons       = .5801407  (mean)
        12._at: muacavg           =       28
                1.HHfoodinsec     = .7756059  (mean)
                2.HHfoodinsec     = .0891321  (mean)
                3.HHfoodinsec     = .0867866  (mean)
                4.HHfoodinsec     = .0484754  (mean)
                0.childsex        =  .511337  (mean)
                1.childsex        =  .488663  (mean)
                0.treatwater      = .8600469  (mean)
                1.treatwater      = .1399531  (mean)
```

```
         0.defpract       = .4558249 (mean)
         1.defpract       = .5441751 (mean)
         0.brstfeedpract  = .0594214 (mean)
         1.brstfeedpract  = .5863956 (mean)
         2.brstfeedpract  =  .275215 (mean)
         3.brstfeedpract  = .0789679 (mean)
         1.HHexp          =  .264269 (mean)
         2.HHexp          = .4769351 (mean)
         3.HHexp          = .2587959 (mean)
         motherage        = 25.60907 (mean)
         0.motherstress   = .8858483 (mean)
         1.motherstress   = .1141517 (mean)
         1.expdecision    = .5160281 (mean)
         2.expdecision    = .3354183 (mean)
         3.expdecision    = .1485536 (mean)
         0.mothersickne~s = .8835027 (mean)
         1.mothersickne~s = .0789679 (mean)
         2.mothersickne~s = .0265833 (mean)
         3.mothersickne~s = .0109461 (mean)
         1.region         = .1118061 (mean)
         2.region         = .2314308 (mean)
         3.region         = .6567631 (mean)
         legumecons       = .7685692 (mean)
         peanutcons       = .1469898 (mean)
         milkcons         = 5.740422 (mean)
         curdcons         = .5199375 (mean)
         proteincons      = .5801407 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
         _at |
          1  |   .4514494   .0480404     9.40   0.000     .3572919    .5456069
          2  |    .422309   .0413937    10.20   0.000     .3411789    .5034391
          3  |   .3936996    .034851    11.30   0.000      .325393    .4620062
          4  |   .3658011   .0286189    12.78   0.000     .3097091    .4218931
          5  |   .3387749   .0229454    14.76   0.000     .2938027    .3837471
          6  |   .3127608   .0181612    17.22   0.000     .2771655     .348356
          7  |   .2878745   .0147242    19.55   0.000     .2590156    .3167334
          8  |   .2642072   .0131147    20.15   0.000     .2385029    .2899115
          9  |   .2418249   .0133681    18.09   0.000     .2156239    .2680259
         10  |   .2207698   .0148525    14.86   0.000     .1916594    .2498802
         11  |   .2010618   .0168205    11.95   0.000     .1680943    .2340293
         12  |   .1827006   .0187978     9.72   0.000     .1458576    .2195435
------------------------------------------------------------------------------
```

Margins for Mother's Stress Levels:

```
. //margins for Mother's Stress Levels
margins, at(muacavg = (17.5(1)28.9)  motherstress = (0 1))

Predictive margins                                       Number of obs = 1,279
Model VCE: OIM

Expression: Pr(stuntstat), predict()
1._at:  muacavg      = 17.5
        motherstress =    0
2._at:  muacavg      = 17.5
        motherstress =    1
3._at:  muacavg      = 18.5
        motherstress =    0
4._at:  muacavg      = 18.5
        motherstress =    1
5._at:  muacavg      = 19.5
        motherstress =    0
6._at:  muacavg      = 19.5
        motherstress =    1
7._at:  muacavg      = 20.5
```

```
        motherstress =    0
8._at:  muacavg      = 20.5
        motherstress =    1
9._at:  muacavg      = 21.5
        motherstress =    0
10._at: muacavg      = 21.5
        motherstress =    1
11._at: muacavg      = 22.5
        motherstress =    0
12._at: muacavg      = 22.5
        motherstress =    1
13._at: muacavg      = 23.5
        motherstress =    0
14._at: muacavg      = 23.5
        motherstress =    1
15._at: muacavg      = 24.5
        motherstress =    0
16._at: muacavg      = 24.5
        motherstress =    1
17._at: muacavg      = 25.5
        motherstress =    0
18._at: muacavg      = 25.5
        motherstress =    1
19._at: muacavg      = 26.5
        motherstress =    0
20._at: muacavg      = 26.5
        motherstress =    1
21._at: muacavg      = 27.5
        motherstress =    0
22._at: muacavg      = 27.5
        motherstress =    1
23._at: muacavg      = 28.5
        motherstress =    0
24._at: muacavg      = 28.5
        motherstress =    1

------------------------------------------------------------------------------
             |            Delta-method
             |     Margin   std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
         _at |
          1  |   .4039069   .0431418     9.36   0.000     .3193506    .4884633
          2  |   .7172175   .1043166     6.88   0.000     .5127608    .9216742
          3  |   .3827744   .0367906    10.40   0.000     .3106662    .4548826
          4  |   .6546964   .0988931     6.62   0.000     .4608694    .8485233
          5  |   .3620545   .0307216    11.79   0.000     .3018413    .4222677
          6  |   .5866339    .088488     6.63   0.000     .4132006    .7600672
          7  |   .3418109   .0250885    13.62   0.000     .2926384    .3909834
          8  |   .5152747    .074573     6.91   0.000     .3691143    .6614351
          9  |   .3221014   .0201139    16.01   0.000     .2826789    .3615238
         10  |   .4433157   .0597819     7.42   0.000     .3261453     .560486
         11  |   .3029772   .0161488    18.76   0.000     .2713262    .3346282
         12  |   .3735417   .0476194     7.84   0.000     .2802094     .466874
         13  |   .2844829   .0137015    20.76   0.000     .2576285    .3113374
         14  |   .3084361   .0411999     7.49   0.000     .2276858    .3891864
         15  |   .2666559   .0131864    20.22   0.000      .240811    .2925007
         16  |   .2498689   .0404778     6.17   0.000     .1705338    .3292039
         17  |   .2495263   .0143949    17.33   0.000     .2213129    .2777398
         18  |   .1989372   .0421179     4.72   0.000     .1163876    .2814868
         19  |   .2331175   .0166085    14.04   0.000     .2005655    .2656696
         20  |   .1559745   .0431547     3.61   0.000     .0713928    .2405563
         21  |   .2174459   .0191975    11.33   0.000     .1798195    .2550722
         22  |    .120688   .0424386     2.84   0.004     .0375098    .2038661
         23  |   .2025211   .0217979     9.29   0.000      .159798    .2452442
         24  |   .0923588   .0399909     2.31   0.021     .0139781    .1707395
------------------------------------------------------------------------------
```

Do File

```
*Y* stuntstat
describe f7cstustat
codebook f7cstustat
tab f7cstustat
summarize f7cstustat
//f7cstustat is coded as 0 - not stunted, 1 stunted
generate stuntstat = f7cstustat
//labeling new variable
label variable stuntstat "stunting status of children"
//allotting labels for subcategories
label define stuntstat_labels 0 "not stunted" 1 "stunted"
label values stuntstat stuntstat_labels
//checking new variable
describe stuntstat
codebook stuntstat
tab stuntstat

*X1* muacavg
//MUACAverage, avg of 3 MUACs taken of the mother
describe MUACAverage
codebook MUACAverage
tab MUACAverage
summarize MUACAverage
//generating a copy of the variable
generate muacavg = MUACAverage
//labeling new variable
label variable muacavg "avg of 3 MUACs taken of the mother"
//the ranges in muacavg for understanding, is min/24=underweight 24/29=ideal weight
29/max=overweight 99.9=Dont know
//removing do not knows
recode muacavg 99.9=.
//checking new variable
describe muacavg
codebook muacavg
tab muacavg
summarize muacavg

*X2* HHfoodinsec
//f4hfiasct, HH Food Insecurity category
describe f4hfiasct
codebook f4hfiasct
tab f4hfiasct
summarize f4hfiasct
//f4hfiasct is coded as 0 = missing values, 1 = none, 2 = mild, 3 = moderate and 4 = severe
//generating a copy of the variable called HHfoodsec
generate HHfoodinsec = f4hfiasct
//labeling new variable
label variable HHfoodinsec "household food insecurity"
//recoding none/no food insecutity currently coded as 1 to 0, mild insecurity currently coded as
2 to 1, moderate currently coded as 3 to 2, severe currently coded as 4 to 3, and 0 which are the
missing values to 99
recode HHfoodinsec (0 = .)
//allotting labels for subcategories
label define HHfoodinsec_labels 1 "none" 2 "mild" 3 "moderate" 4 "severe"
label values HHfoodinsec HHfoodinsec_labels
//checking new variable
describe HHfoodinsec
codebook HHfoodinsec
tab HHfoodinsec

*X3* childsex
//f7chld_sex, Gender of child
describe f7chld_sex
codebook f7chld_sex
tab f7chld_sex
summarize f7chld_sex
//f7chld_sex is coded as 1 = boy , 2 = girl , 66 = missing
//generating a copy of the variable called childsex
```

```
generate childsex = f7chld_sex
label variable childsex "sex of child"
//recoding boy currently coded as 1 to 0, that is the, base category
//recoding girl which is currently 2 to 1
recode childsex (66 = .)
recode childsex 1=0 2=1
//allotting labels for subcategories
label define childsex_labels 0 "male" 1 "female"
label values childsex childsex_labels
//checking new variable
describe childsex
codebook childsex
tab childsex

*X4* treatwater
//f4c_4, treat water before drinking it to make it safe
describe f4c_4
codebook f4c_4
tab f4c_4
summarize f4c_4
//f4c_4 is coded as: No 0, Yes 1, Sometimes 2, NA    97
//generating a copy of the variable called water_treat
generate treatwater = f4c_4
label variable treatwater "treat water before drinking it to make it safe"
//recoding sometimes and NA both as 99
recode treatwater (2 = .)
recode treatwater (97 = .)
//allotting labels for subcategories
label define treatwater_labels 0 "no" 1 "yes"
label values treatwater treatwater_labels
//checking new variable
describe treatwater
codebook treatwater
tab treatwater

*X5* defpract
//f4c_7, where do children defecate or defecation practices
describe f4c_7
codebook f4c_7
tab f4c_7
summarize f4c_7
//f4c_4 is coded as Own toilet - 1, Neighbor's toilet - 2, Outdoor near the house - 3, Open field
- 4 , Bush/Jungle - 6, Diaper - 7, Other - 8, Missing - 66, NA - 97
//River Pool 5 and Do not know 9, both do not show up in the tab, there were zero entries to
these categories
//generating a copy of the variable called def_prac
generate defpract = f4c_7
label variable defpract "where do children defecate or defecation practices"
//recoding def_prac as 0 - Outdoor, 1 - Indoor, other, missing and NA as .
recode defpract (8 = .)
recode defpract (66 = .)
recode defpract (97 = .)
recode defpract 1=1 2=1 3=0 4=0 6=0 7=1
//allotting labels for subcategories
label define defpract_labels 0 "outdoor" 1 "indoor"
label values defpract defpract_labels
//checking new variable
describe defpract
codebook defpract
tab defpract

*X6* brstfeedpract
//Average number of times child was breastfed per day in the last 7 days
describe f7h_4
codebook f7h_4
tab f7h_4
summarize f7h_4
//f7h_4 is coded as none - 0 , 1-10 times - 1, 11-20 times - 2, 21 or more times - 3, NA - 97
//generating a copy of the variable
gen brstfeedpract = f7h_4
label variable brstfeedpract "average number of times child breastfed per day in the last 7 days"
```

```
recode brstfeedpract (97 = .)
//allotting labels for subcategories
label define brstfeedpract_labels 0 "none" 1 "1-10 times" 2 "11-20 times" 3 "21 or more times"
label values brstfeedpract brstfeedpract_labels
//checking new variable
describe brstfeedpract
codebook brstfeedpract
tab brstfeedpract
summarize brstfeedpract

*X7* HHexp
//Total household expenditure (Rs.) during the last 30 days
describe f4e1_1
codebook f4e1_1
tab f4e1_1
summarize f4e1_1
//f4e1_1 is coded as none - 0, 999998 or more - 999998, NA - 9999997
//generating a copy of the variable
gen HHexp = f4e1_1
label variable HHexp "total household expenditure (Rs.) during the last 30 days"
recode HHexp min/7999=1 8000/19999=2 20000/max=3 9999997=.
label define HHexplabels 1 "Low Expense" 2 "Medium Expense" 3 "High Expense"
label values HHexp HHexplabels
//checking new variable
describe HHexp
codebook HHexp
tab HHexp
summarize HHexp

*X8* motherage
//f6moth_age, Age of mother
//Variable good as is, no NA/Missing, can remain quantitative
describe f6moth_age
codebook f6moth_age
tab f6moth_age
summarize f6moth_age
//generating a copy of the variable
gen motherage = f6moth_age
label variable motherage "mother's age"
//checking new variable
describe motherage
codebook motherage
tab motherage
summarize motherage

*X9* motherstress
//f6b7_b, if respondent felt sad all the time in the last 30 days
describe f6b7_b
codebook f6b7_b
tab f6b7_b
summarize f6b7_b
//f6b7_b is coded as no - 0, yes - 1, NA - 97
//generating a copy of the variable
generate motherstress = f6b7_b
label variable motherstress "if respondent felt sad all the time in the last 30 days"
recode motherstress (97=.)
label define motherstress_labels 0 "no" 1 "yes"
label values motherstress motherstress_labels
//checking new variable
describe motherstress
codebook motherstress
tab motherstress
summarize motherstress

*X10* expdecision
//f6l_3h, Who normally takes the decision regarding daily household expenditures
describe f6l_3h
codebook f6l_3h
tab f6l_3h
summarize f6l_3h
```

```
//f6l_3h is coded as self - 1, spouse - 2, self and spouse jointly - 3, other male household
member - 4, other female household member - 5, self and other household member - 6, spouse and
other household member - 7, Other - 8, NA - 97
//generating a copy of the variable
gen expdecision = f6l_3h
label variable expdecision "who normally takes the decision regarding daily HH expenditures"
//recoding
recode expdecision (97=.)
recode expdecision (6=.)
recode expdecision (7=.)
recode expdecision (8=.)
recode expdecision 1=1 2=2 3=3 4=2 5=1 6=3 7=3
label define expdecision_labels 1 "female only" 2 "male only" 3 "female and spouse"
label values expdecision expdecision_labels
//checking new variable
describe expdecision
codebook expdecision
tab expdecision
summarize expdecision

*X11* mothersicknesstatus
//mothersicknesstatus, mother's current ongoing sickness status
egen mothersicknesstatus = rowtotal(f6b_p1 f6b_q1 f6b_r1)
label variable mothersicknesstatus "mother's current ongoing sickness status"
recode mothersicknesstatus (291=.)
label define sickness_status_lbl 0 "No sickness" 1 "Mild sickness" 2 "Moderate sickness" 3
"Severe sickness"
label values mothersicknesstatus sickness_status_lbl
//checking new variable
describe mothersicknesstatus
codebook mothersicknesstatus
tab mothersicknesstatus
summarize mothersicknesstatus

*X12* region
//region, agro-ecological regions : mountains / hills / terai
//terai is plains
label variable region "agro-ecological regions : mountains / hills / terai"
label define region_labels 1 "Mountains" 2 "Hills" 3 "Terai"
label values region region_labels
//checking variable
describe region
codebook region
tab region
summarize region

*X13* legumecons
//f7i1_8, no. of times consumed Other legumes (chickpeas, dried peas, lima beans & soyabeans)
within last 7 days
generate legumecons = f7i1_8
recode legumecons (997=.)
label variable legumecons "no. of times legumes (chickpeas, dried peas, lima beans & soybeans)
were consumed within last 7 days"
//checking new variable
describe legumecons
codebook legumecons
tab legumecons
summarize legumecons

*X14* peanutcons
//f7i1_9, no. of times peanuts were consumed within last 7 days
generate peanutcons = f7i1_9
recode peanutcons (997=.)
label variable peanutcons "no. of times peanuts were consumed within last 7 days"
//checking new variable
describe peanutcons
codebook peanutcons
tab peanutcons
summarize peanutcons

*X15* milkcons
```

```
//No. of times consumed Milk within last 7 days: F7i1_10
generate milkcons = f7i1_10
recode milkcons (997=.)
label variable milkcons "no. of times milk was consumed within last 7 days"
//checking new variable
describe milkcons
codebook milkcons
tab milkcons
summarize milkcons

*X16* curdcons
//No. of times consumed curd/whey within last 7 days: F7i1_11
generate curdcons = f7i1_11
recode curdcons (997=.)
label variable curdcons "no. of times curd was consumed within last 7 days"
//checking new variable
describe curdcons
codebook curdcons
tab curdcons
summarize curdcons

*X17* proteincons
//No of times consumed Chicken/duck within last 7 days: F7i1_17
generate proteincons = f7i1_17
recode proteincons (997=.)
label variable proteincons "no. of times chicken/duck were consumed within last 7 days"
//checking new variable
describe proteincons
codebook proteincons
tab proteincons
summarize proteincons

//Visualizing Y
graph bar (count), over (stuntstat) title (Stunting in Children(6 to 24 months of age))
graph save StuntinginChildren , replace
graph export StuntinginChildren.png , replace

//Visualizing X1
histogram muacavg, bin(100) frequency title (Mother's Nutritional Status(as measured by MUAC))
graph save MothersMUAC , replace
graph export MothersMUAC.png , replace
//Exploring categories of X1
generate MUACAverage_cat = MUACAverage
label variable MUACAverage_cat "MUAC"
recode MUACAverage_cat min/24=1 24/29=2 29/max=3  99.9=.
label define  MUACAverage_cat_labels 1 "Underweight" 2 "Ideal weight" 3 "Overweight"
label values  MUACAverage_cat  MUACAverage_cat_labels
tabulate MUACAverage_cat


//Exploring distribution of quantitative response variable across different categories
graph box muacavg, over(stuntstat) title (Distribution of MUAC over Stunting Status)
graph save SidebysideBoxplots , replace
graph export SidebysideBoxplots.png , replace

//Comparing the mean on the quantitative response variable across different categories
tab stuntstat, summarize (muacavg)
sum muacavg if stuntstat == 0
sum muacavg if stuntstat == 1

//Scatterplot
twoway (scatter stuntstat muacavg) (lfit stuntstat muacavg), title (Stunting and Mother's Health
Association) xtitle (Mother's MUAC) ytitle (Stunting in Children (6 to 24 months of age))
graph save Scatterplot , replace
graph export Scatterplot.png , replace

//Correlation matrix
pwcorr stuntstat muacavg

//LPM Regression results, naive approach
```

```
regress stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract i.brstfeedpract
i.HHexp motherage i.motherstress i.expdecision i.mothersicknesstatus c.muacavg##i.motherstress
i.region legumecons peanutcons milkcons curdcons proteincons

//Checking for multicollinearity
vif

//Logit results (without interaction term)
logit stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract i.brstfeedpract i.HHexp
motherage i.motherstress i.expdecision i.mothersicknesstatus i.region legumecons peanutcons
milkcons curdcons proteincons

//margins (without interaction term)
margins, at(muacavg = (17(1)28)) atmeans

//marginsplot (without interaction term)
marginsplot, noci

//Logit results (with interaction term)
logit stuntstat muacavg i.HHfoodinsec i.childsex i.treatwater i.defpract i.brstfeedpract i.HHexp
motherage i.motherstress i.expdecision i.mothersicknesstatus c.muacavg##i.motherstress i.region
legumecons peanutcons milkcons curdcons proteincons

//margins (with interaction term)
margins, at(muacavg = (17(1)28)) atmeans

//marginsplot (with interaction term)
marginsplot, noci

//margins for Mother's Stress Levels
margins, at(muacavg = (17.5(1)28.9)  motherstress = (0 1))

//marginsplot for Mother's Stress Levels
marginsplot, noci

//Checking for sensitivity and specificity/soundness of model
lstat

//done
```