



کراچی یونیورسٹی

University of Karachi
THE NGDS PILOT PROJECT
The Sibling Growth Pilot Project



SF GROWTH-AND-IMAGING LABORATORY

ADDITIONAL FILE 3

GROWTH-AND-OBESITY VECTOR-ROADMAPS OF THE PAKISTANI CHILDREN

Syed Arif Kamal, Ashfaq Ali Naz and Shakeel Ahmed Ansari*

<http://www.ngds-ku.org/Papers/J43.pdf>

This is the format of the report generated using vector model. Text in BLUE is not part of report handed out to parents of L. G. (header and footer on this page as well as pages 5-12)

GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY

SGPP Case Number: SGPP-KHI-20131021-02 • Date of Report (year-month-day): 2016-03-31

Father's Name: W/H • Mother's Name: W/H • e-mail: W/H • Paper Mail: W/H

Telephone: W/H • Best time to Call: 11 am on Saturday

Table 1_{VECTOR}. Adult-mid-parental (Target) and army-cutoff heights

Father's Height: † 167.16 cm • Mother's Height: † 160.16 cm

| Adult-Mid-Parental (Target) and Army-Cutoff Heights | Boy † | | Girl † | |
|---|--------------|--------------|--------------|--------------|
| | Target | Army-Cutoff | Target | Army-Cutoff |
| Height (cm) | 170.16 | 162.56 | 157.16 | 157.48 |
| Height (ft-in) | 5 ft 6.99 in | 5 ft 4.00 in | 5 ft 1.87 in | 5 ft 2.00 in |
| Percentile | 18.95 | 2.72 | 18.14 | 19.36 |

Table 2_{VECTORa}. Month-wise height and mass (weight) management for

cm: centimeter(s) • ft: foot (feet) • in: inch(es) • kg: kilogram(s) • lb: pound(s) • oz: ounce(s)

MP: Mid-Parental • NA: Not Available • NM: Not Measured • W/H: Withheld to protect privacy

EC I: Energy-Channelization I (Tallness + Wasting) • EC II: Energy-Channelization II (Stunting + Obesity)

EC III: Energy-Channelization III (Puberty-Induced Energy-Channelization) • AM: Acute Malnutrition

ON: Over-Nutrition (Tallness + Obesity) • UN: Under-Nutrition (Stunting + Wasting)

- a). The mother, accompanied by father, could come and discuss strategies for long-term-health protection of their child(ren), on:
Tuesday, April 5, 2016 at 1730h
- b). For explanation of dress and behavior codes see *Manual for Anthropometric Measurements*:
http://www.ngds-ku.org/ngds_folder/M02.pdf
- c). Optimal mass (weight) is the recommended mass based on current height of the incumbent.
- d). WASTED (OBESE) means student has lesser (excess) weight-for-height (do not confuse with everyday meaning of wasted). Detailed guidelines to help maintain optimal weight-for-height are placed at:
<http://www.ngds-ku.org/BLA/Weight.pdf>
- e). If the data are divided into 100 equal parts, each part represents percentile and gives ranking in the sample chosen to collect data.
- f). Estimated-adult height is based on percentile of current height. Adult-mid-parental (Target) height is obtained by adding 6.5 cm to (for boys)/ subtracting 6.5 cm from (for girls) average of parents' heights (in cm).
- g). Some helpful suggestions to increase heights of girls, who are considered short-for-age, are available at the link:
<http://www.ngds-ku.org/BLA/Height.pdf>
- h). All diet-based interventions to maintain appropriate weight-for-height and proper height-for-age would be nullified, if children were suffering from vitamin-D deficiency (VDD). The following link lists some indications as well as remedial measures to spot and overcome VDD:
<http://www.ngds-ku.org/BLA/VDD.pdf>
- i). Cumulative-Scoliosis-Risk Weightage (CSRW) above 5.5, 6.5 or 7.5 after the first, the second or the third checkup, respectively, needs careful observation and follow up. CSRW is determined on the basis of the following criteria:
http://www.ngds-ku.org/BLA/Scoliosis_Risk.pdf
- j). Guidelines to guard against curvatures of spinal column are placed at:
<http://www.ngds-ku.org/Articles/A14.pdf>
- k). This 'Growth-and-Obesity Vector-Roadmap' is generated according to the procedures given in:
<http://www.ngds-ku.org/Papers/J43.pdf>
- l). Next checkup of your family is scheduled on:
Saturday, September 24, 2016 at 0937h
- m). Many thanks for your support and understanding of the work done by the NGDS Team.

Prof. Dr. Syed Arif Kamal
Professor and Project Director
e-mail: profdrakamal@gmail.com

*Project Director, the NGDS Pilot Project and Director, SF Growth-and-Imaging Laboratory

ADDITIONAL FILE 3: GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY

L. G. (SGPP-KHI-20131021-02/01) based on the vector model

Gender: Female † • Date of Birth: August 15, 2007 • School: W/H • GR Number: W/H • Sport: Gymnastics

| Target Date | Height Target | | Mass (Weight) Target | |
|--------------------|---------------|---------------|----------------------|----------------|
| | cm | ft-in | kg | lb-oz |
| April 26, 2016 | 147.77 | 4 ft 10.18 in | 30.93 | 68 lb 3.30 oz |
| May 26, 2016 | 148.28 | 4 ft 10.38 in | 31.84 | 70 lb 3.36 oz |
| 6 June 26, 2016 | 148.79 | 4 ft 10.58 in | 32.98 | 72 lb 11.44 oz |
| July 26, 2016 | 149.30 | 4 ft 10.79 in | 34.34 | 75 lb 11.49 oz |
| August 26, 2016 | 149.82 | 4 ft 10.99 in | 35.71 | 78 lb 11.80 oz |
| September 26, 2016 | 150.35 | 4 ft 11.19 in | 37.04 | 81 lb 10.91 oz |

Table 2_{VECTOR}b. Lifestyle adjustment, diet and exercise plans for L. G. to achieve month-wise targets

| | Height Management | Mass (Weight) Management |
|-----------------------------|--|---|
| Lifestyle Adjustment | Recommended daily dose of vitamin D (600 IU) through 10-15 minute guarded-graduated sun-exposure (early morning or late afternoon) with the child minimally dressed (leaving head, arms, legs and spinal column exposed, last one from external auditory meatus to hip joint; eyes protected through UV-cutoff glasses); 8-hour, night-time, sound sleep dressed in pajama shorts only (3-minute, slow-stroke back massage to improve quality and quantity of sleep); maximum 2-hour screen time (one hour computer/video games — computer monitor at eye level; one hour TV/DVD) — light exercises during TV/DVD watching; for 5 minutes each after waking up, at the end of every hour and before going to bed — bending on sides, focusing eyes far away and moving eyeballs, moving fingers and wrists after computer work and writing, stretching, touching toes without flexing knees, exercising neck muscles (left, right, up, down) | |
| Diet Plans | 3 relaxed and balanced meals, 10-12 glasses of water daily — absolutely NO carbonated drinks To gain height, diet plan should include calcium-, protein- and fiber-rich diet (milk, fresh fruit, chicken and fish) | To put on mass (weight), diet plan should include milk, potato items (baked or boiled, but not fried) and protein-rich diet |
| Exercise Plans | Guarded-graduated exercises preceded by warm-up and followed by cool-down routines To pick up height, child should perform light-stretching exercises (bar hanging, mild-stretching, summersault, cartwheel) | To increase mass (weight), heavy exercises performed for shorter duration, consistently |

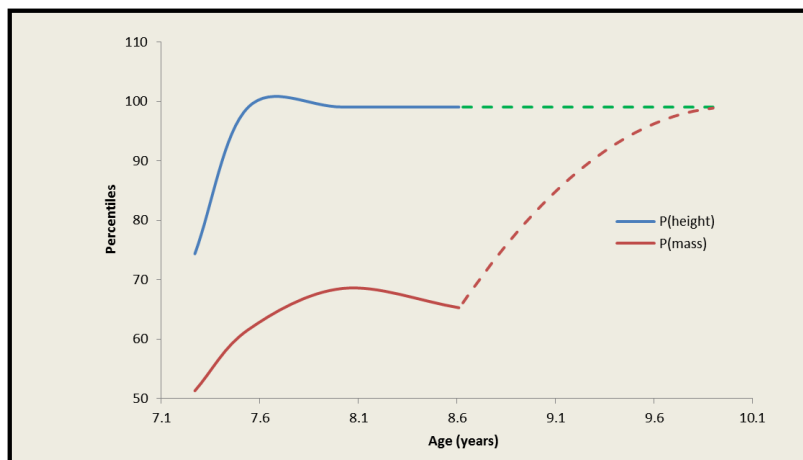


Figure 1_{VECTOR}. Time evolution of L. G.'s height and mass percentiles for her four checkups in the age range 7.27-8.61 years (navigational trajectory: solid curve), including the desired course-of-action (guidance trajectory: green-dashed line) and recommended intervention (control action: none for height-percentile curve and maroon-dashed for mass-percentile curve)

Table 2_{VECTORC}. Growth-and-Obesity Vector-Roadmap of L. G.

| Checkup | 1 st | 2 nd | 3 rd | 4 th |
|--|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Photograph | | | | |
| Scanned Signatures | <i>LG</i> | <i>LG</i> | <i>LG</i> | <i>LG</i> |
| Class and Section | II-B | II-B | III-B | III-B |
| Date of Checkup (year-month-day) | 2014-11-22 | 2015-02-28 | 2015-08-22 | 2016-03-26 |
| Age (year-month-day) | 07-03-07 | 07-05-23 | 08-00-07 | 08-07-11 |
| Age (decimal years) | 7.27 | 7.54 | 8.02 | 8.61 |
| Dress Code | 0/0.5 | 0/0.5 | 0/0.5 | 0/0.5 |
| Behavior Code | 0 | 0 | 0 | 0 |
| Height, h (cm) | 126.96 | 139.92 | 143.51 | 147.255 |
| Height (ft-in) | 4 ft 1.98 in | 4 ft 7.09 in | 4 ft 8.50 in | 4 ft 9.97 in |
| Percentile-of-Height, $P(h)$ | 74.37 | 99.01 | 99.06 | 99.06 |
| Estimated-Adult Height (cm) | 167.59 | 180.04 | 180.44 | 180.42 |
| Estimated-Adult Height (ft-in) | 5 ft 5.98 in | 5 ft 10.88 in | 5 ft 11.04 in | 5 ft 11.03 in |
| CA-MP (Current-Age-Mid-Parental) Height (cm) | 118.00 | 119.59 | 122.25 | 125.27 |
| Δ Height w. r. t. CA-MP Height (cm) | +8.96 | +20.33 | +21.26 | +21.99 |
| Algebraic Status (pertaining-to-height), $STATUS_{\pm}(h)$ | +7.59% | +17.00% | +17.39% | +17.55% |
| Qualitative Status (pertaining-to-height) | 1st-Deg Tall | 2nd-Deg Tall | 2nd-Deg Tall | 2nd-Deg Tall |
| CA-AC (Current-Age-Army-Cutoff) Height (cm) | 118.26 | 119.86 | 122.53 | 125.56 |
| Δ Height w. r. t. CA-AC Height (cm) | +8.70 | +20.06 | +20.98 | +21.70 |
| Reference Height (cm) | 126.96 | 139.92 | 143.51 | 147.255 |
| Percentile-of-Reference-Height | 74.37 | 99.01 | 99.06 | 99.06 |
| Gross Mass (kg) | 23.66 | 25.69 | 28.21 | 29.975 |
| Clothing Correction (kg) | 0 | 0 | 0 | 0 |
| Net Mass, μ (kg) | 23.66 | 25.69 | 28.21 | 29.975 |
| Net Weight (lb-oz) | 52 lb 2.72 oz | 56 lb 10.34 oz | 62 lb 3.25 oz | 66 lb 1.52 oz |
| Percentile-of-Net-Mass, $P(\mu)$ | 51.31 | 61.58 | 68.54 | 65.29 |
| Estimated-Adult Mass (kg) | 58.62 | 61.76 | 63.88 | 62.89 |
| Estimated-Adult Weight (lb-oz) | 129 lb 4.04 oz | 136 lb 2.73 oz | 140 lb 13.64 oz | 138 lb 10.62 oz |
| Optimal Mass (kg) | 26.37 | 39.12 | 42.61 | 46.75 |
| Δ Mass-for-Height (kg) | -2.71 | -13.43 | -14.40 | -16.77 |
| Algebraic Status (pertaining-to-mass), $STATUS_{\pm}(\mu)$ | -10.28% | -34.33% | -33.80% | -35.88% |
| Qualitative Status (pertaining-to-mass) | 2nd-Deg Wasted | 4th-Deg Wasted | 4th-Deg Wasted | 4th-Deg Wasted |
| Cumulative-Scoliosis-Risk Weightage (CSRW) | 8.50 | 9.00 | 9.00 | 9.50 |
| Estimated-Adult BMI (kg/m^2) | 20.87 | 19.05 | 19.62 | 19.32 |
| Nutritional Status | EC I | EC I | EC I | EC I |
| $P(h) + P(\mu)$ | 125.68 | 160.60 | 167.59 | 164.34 |
| Build | Medium | Big | Big | Big |

Need to take care of the checked items for L. G.:

- ⊗ 1. Optimal-weight management advised — note (d) on page-1 footer **(pseudo-gain of mass: physical gain with percentile drop)**
- 2. Your child seems not to gain height, optimally — note (g) on page-1 footer
- ⊗ 3. Guard against your child acquiring scoliosis — notes (i, j) on page-1 footer **(CSRW increased to 9.50)**
- 4. Signs of anemia observed; your child may have vitamin-D deficiency — note (h) on page-1 footer

ADDITIONAL FILE 3: GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY

Table 3_{VECTORa}. Month-wise mass (weight) management for parents

Father's Date of Birth: † July15, 1971 • Mother's Date of Birth: † January 2, 1979

| Target Date | Father † | | Mother † | |
|-------------------|----------|-----------------|----------|-----------------|
| | kg | lb-oz | kg | lb-oz |
| December 22, 2014 | 63.39 | 139 lb 12.40 oz | 70.39 | 155 lb 3.36 oz |
| January 22, 2015 | 64.12 | 141 lb 6.15 oz | 69.62 | 153 lb 8.19 oz |
| February 22, 2015 | 64.85 | 142 lb 15.91 oz | 68.85 | 151 lb 13.03 oz |
| March 22, 2015 | 65.58 | 144 lb 9.66 oz | 68.08 | 150 lb 1.86 oz |
| April 22, 2015 | 66.32 | 146 lb 3.77 oz | 67.32 | 148 lb 7.05 oz |
| May 22, 2015 | 67.06 | 147 lb 13.88 oz | 66.56 | 146 lb 12.24 oz |

Table 3_{VECTORb}. Lifestyle adjustment, diet and exercise plans for parents to achieve month-wise targets

| | Father † | Mother † |
|-----------------------------|---|--|
| Lifestyle Adjustment | Active and carefree lifestyle, lesser screen time, outdoor activities combined with light reading and social interactions, 6-hour night-time sound sleep | |
| Diet Plans | 3 relaxed and balanced meals, 10-12 glasses of water daily — absolutely NO carbonated drinks To put on mass (weight), diet plan should include milk, potato items (baked or boiled, but not fried) and protein-rich diet | To shed off mass (weight), diet plan should include salad, yogurt and skimmed milk |
| Exercise Plans | Guarded-graduated exercises preceded by warm-up and followed by cool-down routines To put on mass (weight), father should perform heavy exercises for shorter duration, consistently | To shed off mass (weight), mother should perform light exercises longer duration, consistently |

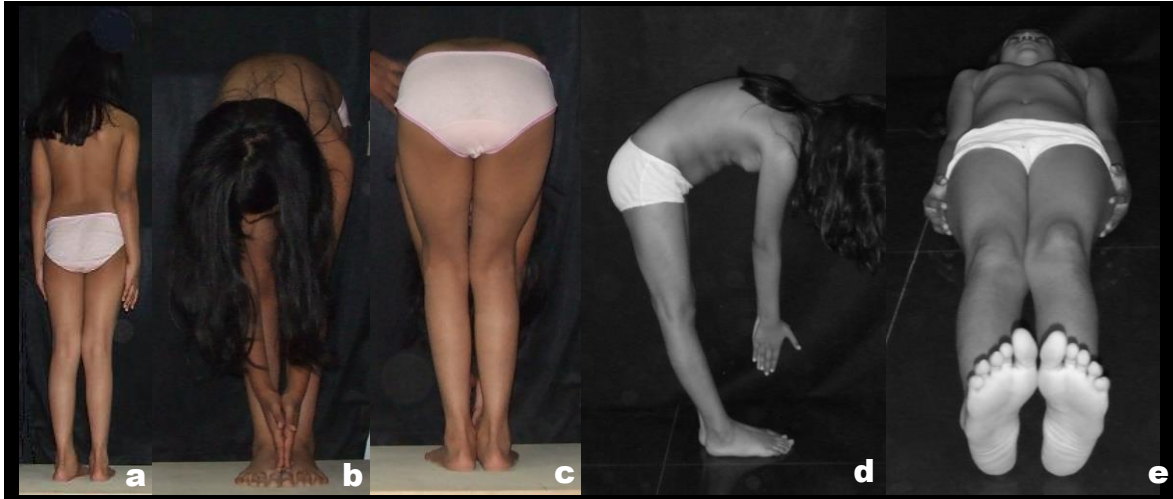
Table 3_{VECTORc}. Obesity Roadmaps of parents

| | Father † | Mother † |
|--|----------------------------------|---------------------------------|
| Date of Checku (year-month-day) | 2014-11-22 | 2014-11-22 |
| Age (year-month-day) | 43-04-07 | 35-10-20 |
| Age (decimal years) | 43.36 | 35.89 |
| Dress Code | 1.5/2 | 2/2 |
| Height, h (cm) | 167.16 | 160.16 |
| Height (ft-in) | 5 ft 5.81 in | 5 ft 3.06 in |
| Gross Mass (kg) | 62.96 | 71.46 |
| Clothing Correction (kg) | 0.30 | 0.30 |
| Net Mass, μ (kg) | 62.66 | 71.16 |
| Net Weight (lb-oz) | 138 lb 2.64 oz | 156 lb 14.52 oz |
| Optimal Mass (kg) | 67.06 | 66.56 |
| Δ Mass-for-Height (kg) | -4.40 | +4.60 |
| Algebraic Status (pertaining-to-mass), $STATUS_{\pm}(\mu)$ | -6.56% | +6.91% |
| Qualitative Status (pertaining-to-mass) | 1st-Deg Wasted | 1st-Deg Obese |
| Body-Mass Index, BMI (kg/m ²) | 22.42 | 27.74 |
| $P(h) + P(\mu)$ | 31.45 | 118.16 |
| Build | Small | Medium |

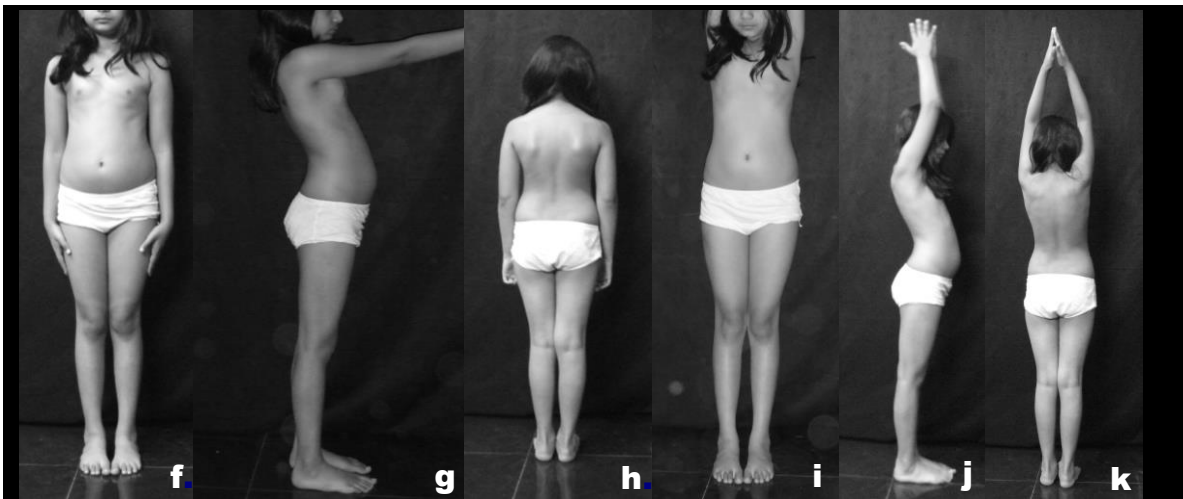
HISTORY AND PHYSICAL EXAMINATION of L. G.

| |
|--|
| L. G.: Female, 7+ at the first checkup, biological child |
| Family History: Non-cousin marriage, blood group B+ of father and mother, both parents working, graduates in medical science, father has cardiac problems, mother diabetic and has congenital optic nerve weakness |
| Pregnancy, Delivery and Neonatal: Pregnancy normal, cesarean delivery after 36 weeks of pregnancy, birth length 41.65 cm, birth mass 3.5 kg, blood group B+, jaundice at birth, weaning mode — bottle |
| Sleep Pattern and Diet Habits: 9-10 hour sleep, 3 balanced meals, 2 balanced snacks (both parents studied nutrition in undergraduate work) |
| Academics and Social Interaction: Reserved, independent, bold, academically doing well, behavior in lab good, quiet, cooperative, tried to replicate anthropometric techniques on father |
| Sports and Co-Curricular Activities: Racing, gymnastics, dancing and music |
| Physical Examination: L. G. was examined completely undressed wearing only panties (barefoot, stripped-to-waist) to thoroughly check nutritional status, posture, gait and presence of trunk deformities (scoliosis, kyphosis and lordosis). Visual, forward bending and moiré examinations of the spinal column were performed, lips bluish, teeth rough on edges, nails whitish with white spots, toes converging observed in gait away and towards, midline of back S shaped, shoulders, scapulae and spinal dimples uneven, body triangles not equal and plumb-line not aligned, front and back, not able to touch toes |

CLINICAL PHOTOGRAPHS OF L. G.



Figures $2_{\text{VECTOR}a-e}$. Posture and forward bending photographs of L. G.: (a) posture of back; (b)-(d) forward-bending tests; (e) posture with the child supine — (a)-(c) taken on November 22, 2014; (d), (e) on March 26, 2016



Figures $2_{\text{VECTOR}f-k}$. Posture (f)-(h) and mild stretching (i)-(k) photographs of L. G. taken on March 26, 2016

COLOR-CODING FOR VARIOUS TABLES

Table 4_{VECTORa}. Row separation in 1_{VECTOR}, 2_{VECTORa} and 3_{VECTORa}

| | | | |
|-------|-----|---------|-------|
| White | Hue | 170 255 | Red |
| | Sat | 000 255 | Green |
| | Lum | 255 255 | Blue |
| Grey | Hue | 170 230 | Red |
| | Sat | 000 230 | Green |
| | Lum | 230 230 | Blue |

Table 4_{VECTORb}. Row separation in Tables 2_{VECTORb} and 3_{VECTORb}

| | | | |
|----------------------|-----|---------|-------|
| Lifestyle Adjustment | Hue | 021 255 | Red |
| | Sat | 255 204 | Green |
| | Lum | 204 153 | Blue |
| Diet Plan | Hue | 234 255 | Red |
| | Sat | 255 153 | Green |
| | Lum | 204 204 | Blue |
| Exercise Plan | Hue | 127 204 | Red |
| | Sat | 255 255 | Green |
| | Lum | 230 255 | Blue |

Table 4_{VECTORc}. Row separation in Tables 2_{VECTORc} and 3_{VECTORc}

Blue arrows point to color scheme used in table inserted in journal paper (without row separation)

| Vital Statistics | | | |
|------------------|-----|---------|-------|
| Light | Hue | 042 255 | Red |
| | Sat | 255 255 | Green |
| | Lum | 204 153 | Blue |
| Dark | Hue | 042 255 | Red |
| | Sat | 255 255 | Green |
| | Lum | 169 083 | Blue |
| Height Data | | | |
| Light | Hue | 149 189 | Red |
| | Sat | 255 222 | Green |
| | Lum | 222 255 | Blue |
| Dark | Hue | 149 153 | Red |
| | Sat | 255 204 | Green |
| | Lum | 204 255 | Blue |
| Mass Data | | | |
| Light | Hue | 234 255 | Red |
| | Sat | 255 153 | Green |
| | Lum | 204 204 | Blue |
| Dark | Hue | 234 255 | Red |
| | Sat | 255 117 | Green |
| | Lum | 186 186 | Blue |
| Combined Data | | | |
| Light | Hue | 085 204 | Red |
| | Sat | 255 255 | Green |
| | Lum | 230 204 | Blue |
| Dark | Hue | 085 129 | Red |
| | Sat | 255 255 | Green |
| | Lum | 192 129 | Blue |

Table 5_{VECTOR}*a*. Status (pertaining-to-height) — qualitative and algebraic

| | | | | |
|--------------------------------------|-------------------|-------------------------------|----------------------|--------------------------------------|
| 4th-Degree Stunted | Hue Sat Lum | 000 255 255 000 128 000 | Red Green Blue | $STATUS_{\pm}(h) < -30$ |
| 3rd-Degree Stunted | Hue Sat Lum | 019 227 233 108 119 010 | Red Green Blue | $-30\% \leq STATUS_{\pm}(h) < -20\%$ |
| 2nd-Degree Stunted | Hue Sat Lum | 032 255 255 192 128 000 | Red Green Blue | $-20\% \leq STATUS_{\pm}(h) < -10\%$ |
| 1st-Degree Stunted | Hue Sat Lum | 042 255 255 255 128 000 | Red Green Blue | $-10\% \leq STATUS_{\pm}(h) < -1\%$ |
| Normal | Hue Sat Lum | 104 000 255 176 088 080 | Red Green Blue | $-1\% \leq STATUS_{\pm}(h) < +1\%$ |
| 1st-Degree Tall | Hue Sat Lum | 042 255 255 255 128 000 | Red Green Blue | $+1\% \leq STATUS_{\pm}(h) < +10\%$ |
| 2nd-Degree Tall | Hue Sat Lum | 032 255 255 192 128 000 | Red Green Blue | $+10\% \leq STATUS_{\pm}(h) < +20\%$ |
| 3rd-Degree Tall | Hue Sat Lum | 019 227 233 108 119 010 | Red Green Blue | $+20\% \leq STATUS_{\pm}(h) < +30\%$ |
| 4th-Degree Tall | Hue Sat Lum | 000 255 255 000 128 000 | Red Green Blue | $STATUS_{\pm}(h) \geq +30\%$ |

Table 5_{VECTOR}*b*. Status (pertaining-to-mass) — qualitative and algebraic

| | | | | |
|-------------------------------------|-------------------|-------------------------------|----------------------|--|
| 4th-Degree Wasted | Hue Sat Lum | 000 255 255 000 128 000 | Red Green Blue | $STATUS_{\pm}(\mu) < -30$ |
| 3rd-Degree Wasted | Hue Sat Lum | 019 227 233 108 119 010 | Red Green Blue | $-30\% \leq STATUS_{\pm}(\mu) < -20\%$ |
| 2nd-Degree Wasted | Hue Sat Lum | 032 255 255 192 128 000 | Red Green Blue | $-20\% \leq STATUS_{\pm}(\mu) < -10\%$ |
| 1st-Degree Wasted | Hue Sat Lum | 042 255 255 255 128 000 | Red Green Blue | $-10\% \leq STATUS_{\pm}(\mu) < -1\%$ |
| Normal | Hue Sat Lum | 104 000 255 176 088 080 | Red Green Blue | $-1\% \leq STATUS_{\pm}(\mu) < +1\%$ |
| 1st-Degree Obese | Hue Sat Lum | 104 000 255 176 088 080 | Red Green Blue | $+1\% \leq STATUS_{\pm}(\mu) < +10\%$ |
| 2nd-Degree Obese | Hue Sat Lum | 032 255 255 192 128 000 | Red Green Blue | $+10\% \leq STATUS_{\pm}(\mu) < +20\%$ |
| 3rd-Degree Obese | Hue Sat Lum | 019 227 233 108 119 010 | Red Green Blue | $+20\% \leq STATUS_{\pm}(\mu) < +30\%$ |
| 4th-Degree Obese | Hue Sat Lum | 000 255 255 000 128 000 | Red Green Blue | $STATUS_{\pm}(\mu) \geq +30\%$ |

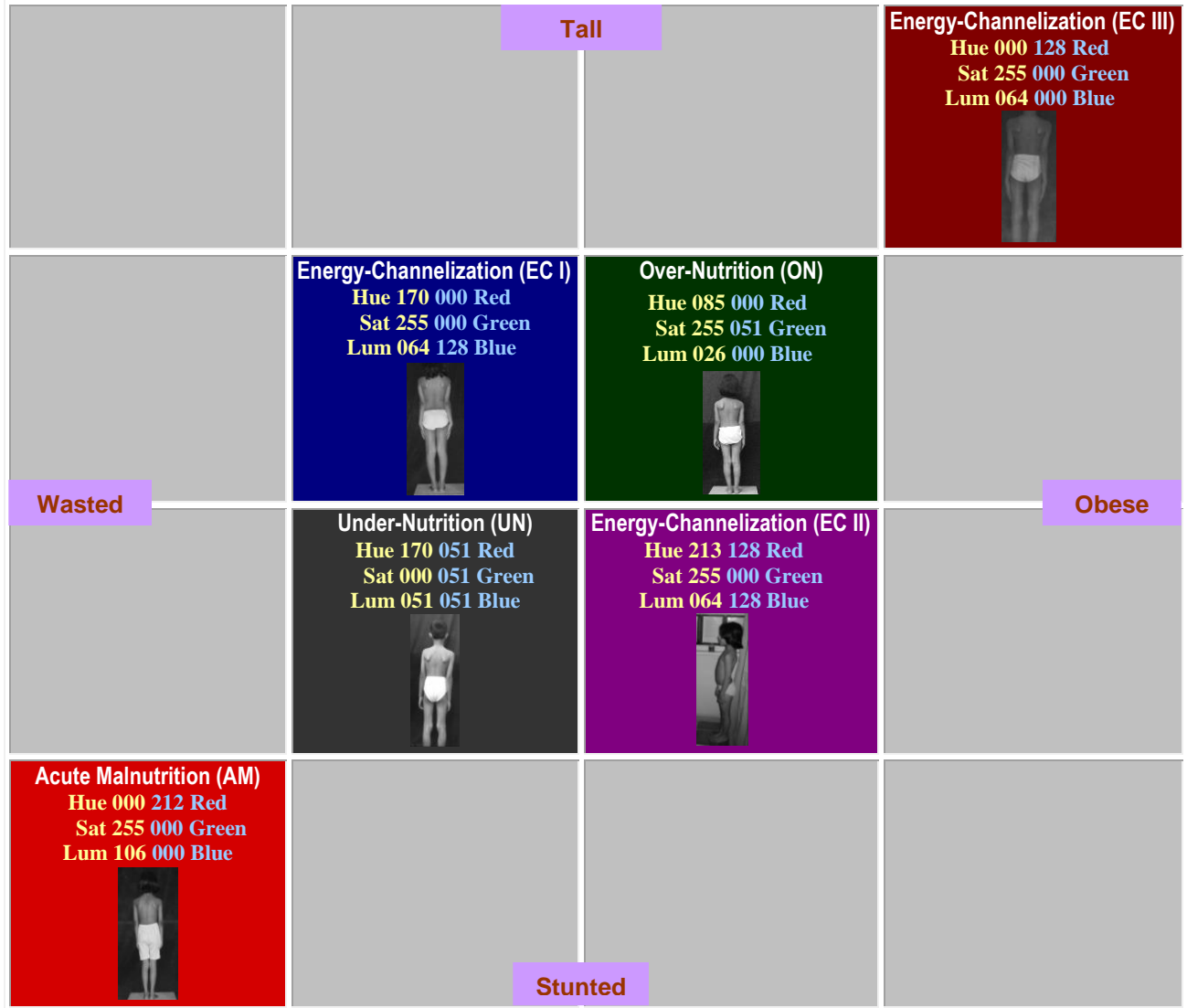


Figure 3_{VECTOR}*a*. Coordinate-plane representation of nutritional status — acute malnutrition is the limiting situation of under-nutrition; energy-channelization III (puberty-induced energy-channelization) is the limiting case of over-nutrition

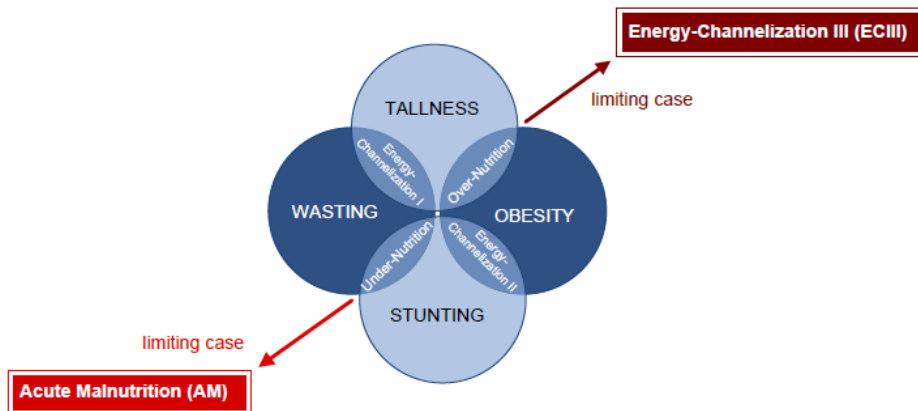


Figure 3_{VECTOR}*b*. Venn-diagrammic representation of nutritional status

Table 6_{VECTORa}. Month-wise height and mass management in scalar-roadmap

Scalar Model: http://www.ngds-ku.org/Presentations/Vector/Additional_File_1.pdf

| | | |
|-----|---------|-------|
| Hue | 000 128 | Red |
| Sat | 255 000 | Green |
| Lum | 064 000 | Blue |

Table 6_{VECTORa}. Estimated-adult height

<: Lesser than Army-Cutoff Height • >: In Excess of Army-Cutoff Height
 Army-Cutoff Height for the Pakistani Youth: 5 feet 4 inches for males and 5 feet 2 inches for females

| | | | |
|---|-----|---------|-------|
| < | Hue | 000 255 | Red |
| | Sat | 255 000 | Green |
| | Lum | 128 000 | Blue |
| > | Hue | 106 051 | Red |
| | Sat | 128 153 | Green |
| | Lum | 102 102 | Blue |

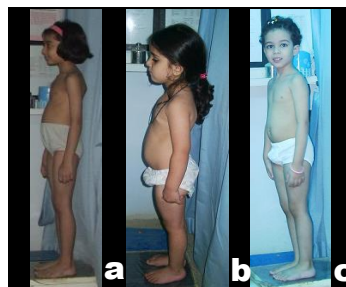
Table 6_{VECTORb}. Severity of acute malnutrition (where present)

Example: <http://www.ngds-ku.org/Papers/J40.pdf>

| | | |
|-----|---------|-------|
| Hue | 000 255 | Red |
| Sat | 255 000 | Green |
| Lum | 128 000 | Blue |

Table 6_{VECTORc}. Classification of build

| | | | |
|--------|-----|---------|-------|
| Small | Hue | 000 255 | Red |
| | Sat | 255 000 | Green |
| | Lum | 128 000 | Blue |
| Medium | Hue | 104 000 | Red |
| | Sat | 255 176 | Green |
| | Lum | 088 080 | Blue |
| Big | Hue | 042 255 | Red |
| | Sat | 255 255 | Green |
| | Lum | 128 000 | Blue |



Figures 4_{VECTORa-c}. From left to right, examples of children of different builds — (a) small, (b) medium and (c) big

DERIVATION OF EQUATION OF PARABOLA

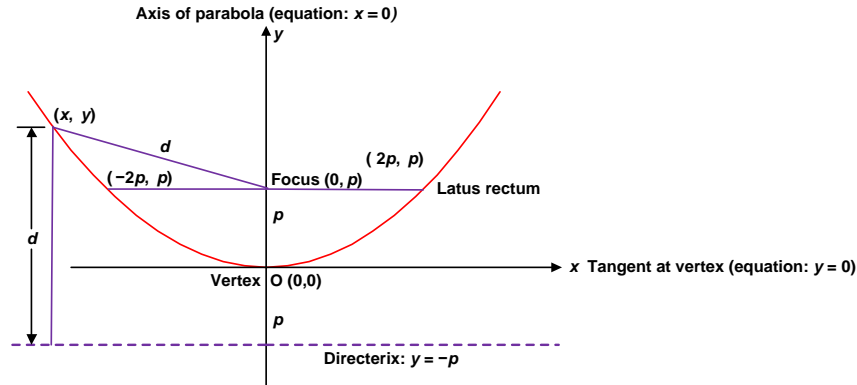


Figure 5_{VECTOR}. Drawing used to derive equation of parabola
(Source: <http://www.intmath.com>)

The parabola is defined as the curve generated from the locus of a point, which moves in such a manner so that it remains, always, at the same distance from a fixed point (termed as ‘focus’) and a given line (termed as ‘directrix’). ‘Latus rectum’ is the line segment parallel to directrix passing through focus with end points on the parabolic curve. ‘Axis of symmetry’ (also called ‘axis of parabola’) is the line normal to directrix passing through focus. To derive equation of a parabola opening on top, whose vertex lies at the origin (0, 0) with y axis (equation: $x = 0$) as axis of symmetry[§], take (0, p) be the coördinates of focus. The equation of directrix may be written as $y = -p$. If (x, y) is a point on the curve, then applying distance formula (derived using Pythagoras theorem), one gets

$$\sqrt{(x-0)^2 + (y-p)^2} = y + p$$

Squaring both sides and simplifying one gets

$$x^2 = 4py$$

which is the equation of parabola. The latus rectum is part of the line $y = p$. Substituting this value of y in the above equation and solving for x, one gets 2 values, $-2p$ and $+2p$. Hence the end points of line segment, which constitute latus rectum, come out to be $(-2p, p)$ and $(2p, p)$. Therefore, length of latus rectum is $4p$. The x-axis (equation: $y = 0$) is tangent to parabola at the vertex, which could, also, be visualized as perpendicular bisector of line segment, which has end points as focus and intersection of symmetry axis and directrix. If the vertex is translated (shifted) to (x_0, y_0) , the equation of parabola becomes

$$(x - x_0)^2 = 4p(y - y_0)$$

The equation of directrix, then, becomes $y = y_0 - p$, the equation of axis of symmetry, $x = x_0$, equation of tangent to parabola, $y = y_0$, the coördinates of focus take the shape $(x_0, y_0 + p)$ and the end points of latus rectum could be expressed as $(x_0 - 2p, y_0 + p)$ and $(x_0 + 2p, y_0 + p)$. Length of latus rectum remains unchanged.

[§] which means that for every point (x, y) on the parabola, there exists a mirror point $(-x, y)$ on the parabolic curve

DESIRED TRAJECTORIES FOR HEIGHT AND MASS PERCENTILES

Table 7_{VECTOR}a. Percentile of height, h , as a function of age, A

$$P(h, A) = 99.0559863$$

Table 7_{VECTOR}b. Percentile of mass, μ , as a function of age, A

$$P(\mu, A) = 99.0559863 - 17.5557474(A - 10)^2$$

Table 7_{VECTOR}c. Percentiles of height and mass on the dates, for which recommendations are generated

Date of Last (Fourth) Checkup: March 26, 2016 • *Decimal Age, A_0* [¶] = 8.613054869 years

$$P_{\text{ref}}^{\parallel} = 99.0559863 \bullet P(h, A_0)^{\parallel} = 99.0559863 \bullet P(\mu, A_0)^{\parallel} = 65.28545564$$

| <i>Dates of Recommendation</i> | <i>Decimal Age, A_i (years)</i> | <i>$P(h, A_i)$</i> | <i>$P(\mu, A_i)$</i> |
|--------------------------------|--|-------------------------------|---------------------------------|
| April 26, 2016 | 8.697754 | 99.0559863 | 69.28418086 |
| May 26, 2016 | 8.779722 | 99.0559863 | 72.91408222 |
| June 26, 2016 | 8.864421 | 99.0559863 | 76.41715328 |
| July 26, 2016 | 8.946388 | 99.0559863 | 79.56738940 |
| August 26, 2016 | 9.031088 | 99.0559863 | 82.57480639 |
| September 26, 2016 | 9.115787 | 99.0559863 | 85.33033360 |

[¶] A_0 is the reference age, when control action is initiated; $P(h, A_0)$ represents percentile of height at the most-recent checkup, taken as reference; $P(\mu, A_0)$ represents percentile of mass at the most-recent checkup, taken as reference; P_{ref} is the reference percentile obtained by selecting maximum value of percentile of current height, $P(h, A_0)$, percentile of army-cutoff height, P_{AC} , and percentile of mid-parental height, P_{MP} .

Web address of the main document:

GROWTH-AND-OBESITY VECTOR-ROADMAPS OF THE PAKISTANI CHILDREN
<http://www.ngds-ku.org/Papers/J43.pdf>

Web address of this document:

Additional File 3: GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY
http://www.ngds-ku.org/Papers/J43/Additional_File_3.pdf