described history, definition, epidemiology, diagnostic perspectives, psychological considerations, musculoskeletal as well as endocrine complications and principles of management related to obesity in youngsters. Akram *et al.* (2018) explained the impacts of behavioral, environmental and social factors on obesity. Kumar and Kelly (2018) reviewed epidemiology, etiology, comorbidities and clinical assessment of childhood obesity. Bramante *et al.* (2019) described natural experiments for childhood obesity prevention and control. Brock *et al.* (2019) looked into the ways of building and sustaining capacity to address obesity in children.

THE NGDS PILOT PROJECT

As per directives of Governor Sindh/Chancellor, University of Karachi, a retired Lieutenant General of the Pakistan Army, a team from University of Karachi, led by the first author (SAK), took up the assignment to establish National Growth and Developmental Standards (NGDS) for the Pakistani children. In 1998, this team initiated the NGDS Pilot Project in 3 institutions administered by the Armed Forces of Pakistan — Army Public School, 'O' Levels, Fazaia Degree College, PAF Base 'Faisal' and Bahria College, NORE I, all located in Karachi, on the basis of letters from the Secretariat of Governor Sindh, bearing numbers GS/2-55/98 (SO-I)/2531, 2530 and 2529, all dated November 25, 1998, addressed to HQ 5 Corps, Commanding Officer, Bahria Complex, NORE I and Base Commander, PAF Base 'Faisal', respectively. In 2011, a civilian school (Beacon Light Academy, Karachi) was included in the study. The NGDS Pilot Project was convened following protocols of 'Institutional Review Process', which included applicable human-right and ethical standards for this region (Additional File 1 of Kamal *et al.*, 2016*a*). 'Opt-in policy', was used for participation, requiring parents to complete and sign 'Informed Consent Form'. Examinations were conducted taking care of comfort, confidentiality, dignity, privacy and safety of students. Due attention was paid to posture (knees joining), detection of scoliosis using visual examination, Adam's forward bending test, moiré fringe topography and dotted-rasterstereography as well as gait (Kamal *et al.*, 2016*b*) during walking (toes inward/outward) and running (knees knocking). In addition, estimated-adult height was computed for each student to find out whether the individual was able to qualify for induction in the Armed Forces of Pakistan or not (Kamal *et al.*, 2017*c*). Students' data (demographic and clinical) were entered in a structured form. Name, birth date, gender, education and occupation of parents as well as siblings' details were included in the demographic data.

Statuses pertaining to heights and masses as well as recommendations to achieve height and maintain mass during the next 6 *months* of a child, Hr. S., were earlier computed using Growth-and-Obesity Vector-Roadmap 1.1 (Kamal *et al.*, 2017*c*). The techniques have now been fine-tuned and calculations could be performed using Growth-and-Obesity Vector-Roadmap 2.6 — detailed method of construction of Roadmap 2.6 is included in Additional File 3 of Kamal *et al.* (2021*a*). Roadmap 2.6 of Hr. S. is made available in Appendix A. It would be of interest to compare these results with those of Roadmap 1.1 included in Kamal *et al.* (2017*c*).

SALIENT FEATURES

The unique features and accomplishments of the NGDS Pilot Project, now in the 24th *year* since its inception, are summarized below:

- Procedures established (Figures 1*a*, *b*), documented — manual developed (Kamal, 2016) as well as step-by-step, illustrated and labeled instructions prepared (Additional File 1 of Kamal *et al.*, 2021*a*) and validated for height measurements to least counts of 0.1 *cm* (1998-2011) — setsquare set; 0.01 *cm* (2012-2015) — Vernier scale; 0.005 *cm* (2016 onward) — enhanced-Vernier scale and mass (weight) measurements to least counts of 0.5 *kg* (1998-2011) — bathroom scale; 0.01 *kg* (2012-2015) — modified-beam scale; 0.005 *kg* (2016 onward) — enhanced-beam scale (Kamal *et al.*, 2016*a*); CDC Growth Charts and Tables extended to percentile range 0.01^{P}-99.99^{P} (Kamal and Jamil, 2014), scaled percentiles (Kamal *et al.*, 2017*b*) and modified-scaled percentiles introduced (Kamal *et al.*, 2021*a*).
- For aspiring youngsters dreaming to serve their country through enlistment in the military and the paramilitary occupations, model and software computed estimated-adult height and difference of measured height and current-age-army-cut-off height; 6 monthly recommendations for height gain given to students (Kamal *et al.*, 2016*a*) and height-gain-target-achievement index (Kamal *et al.*, 2020*a*) computed based on current and previous checkups.
- The first- to the ninth-generation solutions of childhood obesity put forward (Kamal *et al.*, 2021*b*).
- Concepts of energy channelization (Kamal *et al.*, 2014), estimated-adult *BMI* (Kamal and Jamil, 2012), specific *BMI* (Kamal *et al.*, 2020*a*), degree of obesity/wasting and tallness/stunting (Kamal *et al.*, 2011) as well as pseudo-gain of height/mass introduced (Kamal *et al.*, 2014).
- Definitions of true obesity/wasting/tallness/stunting as well as instantaneous obesity/wasting/tallness/stunting given [true obesity (Kamal, 2017); true wasting (Kamal *et al.*, 2017*a*); true tallness and true stunting (Kamal *et al.*, 2021*b*)]; 6 monthly recommendations for mass management, on the basis of height-percentile-based-optimal mass (Kamal *et al.*, 2011) and *BMI*-based-optimal mass (Kamal, 2017), provided to students and mass-management-target-achievement index (Kamal *et al.*, 2020*a*) computed based on current and previous checkups.