OVERCOMING VITAMIN-D DEFICIENCY IN MALE GYMNASTS DURING PRETEEN YEARS

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ABSTRACT

This paper addresses the issue of vitamin-D deficiency, which is approaching epidemic scale in the Asian countries. Lack of proper nutrition and awareness contributes to this problem. After an explanation of the mechanism of production of vitamin D, the authors list adverse effects of vitamin-D deficiency and propose mandatory testing of vitamin-D deficiency during physical examinations. The remedial measures to overcome this deficiency in the context of preteen male gymnasts include supplements, proper nutrition in the form of sun-ripe fruits and vegetables as well as guarded-graduated sun-exposure. The last two are preferred over supplements as the supplements may produce toxicity if taken in higher doses.

Key Words: *diet-based intervention, supplements, sun-ripe fruits/vegetables, guarded-graduated sun-exposure, school-age child*

INTRODUCTION

Vitamin-D deficiency is becoming an epidemic in this part of the world. The problem is compounded by a lack of proper nutrition in preteen youngsters and awareness. Vitamin D is defined as a group of secosteroids, which are fat-soluble. This vitamin is responsible for increasing intestinal absorption micrantrients, which include calcium, magnesium and phosphate as well as a number of other biological effects. The paper explains the mechanism of production of vitamin D and lists adverse effects of vitamin-D deficiency. If a mandatory testing is introduced during pre-participation and end-of-the-term physical examinations of preteen male gymnasts, remedial measures could be taken before serious harm is done to their bodies. The remedial measures to overcome this deficiency include vitamin-D supplements (oral and injectable), food items (sun-ripe fruits and vegetables) as well as sun-exposure (guarded and graduated). The last two are preferred over supplements as the supplements may produce toxicity if over-prescribed.

MECHANISM OF VITAMIN-D PRODUCTION

According to Dr. Laura Tripkovic (Surrey University) and Prof. Richard Cogdell (Glasgow University) vitamin D is needed to maintain our bones and to make sure we absorb enough calcium from our diet. Sun radiation penetrates skin-layers called the epidermis, while there's a chemical called 7-hydrocholesterol. This chemical is absorbed through ultraviolet light to produce the pre-vitamin-D molecule. Warm skin converts pre-vitamin D3 to vitamin D3, which moves from the skin, pushed out into the capillary system and, eventually, into the blood system, where it can then be activated and used.

Figure-1:
Adverse effects of vitamin-D deficiency

Alzheimer's disease
Autoimmune diseases
Backache
Cancer
Chronic fatigue
Infectious diseases
Kidney stones
Muscular and joint pain
Nullification of calcium-rich diet-plans
Progressively weakening eyesight
In very young children
Chronic flu
Delayed teething
Skull-bone hardening
During early childhood
Rickets
Tuberculosis
During later childhood and adolescence
Kyphosis
Lordosis
Scoliosis
During adulthood
Osteomalacia
During old age
Osteoporosis

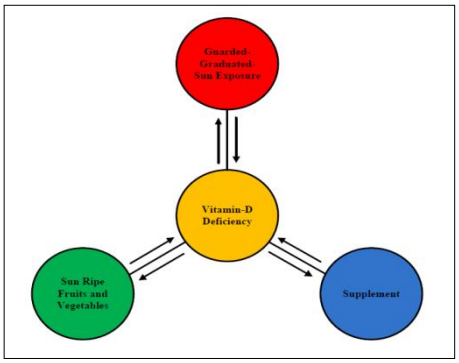
Adverse Effects of Vitamin-D Deficiency

Zahoor (2012) mentioned a UK study, which isolated the problem in the population from Asia. 13 out of 14 found cases of vitamin-D deficiency were found in the Asian children. In fact, there are a lot of cases of vitamin-D deficiency in the East, in particular, Pakistan. According to the Consensus Report of the Institute of Medicine a daily dose of 600 IU is recommended to maintain bones to prevent rickets and tuberculosis (during early childhood), scoliosis, kyphosis and lordosis (during later childhood and adolescence) as well as osteomalacia (during adulthood) and osteoporosis (during old age). Untreated deficiency may be the cause of backache, chronic fatigue, muscular and joint pain as well as

progressively weakening eyesight. In very young children, it may lead to chronic flu, delayed teething and hardening of the skull-bone. Further, deficiency of this vitamin may cause Alzheimer's disease, autoimmune diseases, cancer, infectious diseases and kidney stones (Kamal *et al.*, 2013*c*). Vitamin-D deficient athletes risk stress fractures, respiratory infections and muscle injuries (Angeline *et al.*, 2013; Koundourakis *et al.*, 2016).

Vitamin-D deficiency prevents calcium to be, properly, absorbed from diet and contribute towards strengthening the bones and preventing scoliosis (Kamal *et al.*, 2015; 2016*d*), gaining height through tissue synthesis (Kamal *et al.*, 2013*d*) and maintaining optimal weight (Kamal *et al.*, 2013*a*). According to Villacis *et al.* (2014), male athletes are more likely to be vitamin-D deficient as compared to their female counterparts. Figure-1 lists some of the adverse effects of vitamin-D deficiency in different phases of life.

Figure-2:
Measures to overcome vitamin-D deficiency first appeared in Kamal (2017*b*)



Some Remedial Measures

Figure-2 shows measures to overcome vitamin-D deficiency. They are described below**:**

Supplements

At times supplements are prescribed to overcome vitamin-D deficiency. The authors do not endorse supplementation via intramuscular injection, tablets or syrups, as these measures, sometimes, cause severe vitamin-D toxicity as the vitamin may fail to absorb in the body. The supplements, given through injection, sometimes cause swelling and other complications, if they are injected in the arm.

Sun-Ripe Fruits and Vegetables

Sun-ripe fruits and vegetables, also, provide vitamin D and are the natural way to overcome deficiency.

Guarded-Graduated Sun-Exposure

Air and sun exposure is needed to give students adequate doses of vitamin-D. a guarded-graduated approach should build up tolerance to sun-exposure, resistance to common colds as well as produce a melanin layer on skin, which protects the students from getting skin cancer, at the same time acclimatizing child to heat effects (American Academy of Pediatrics — Committee on Sports Medicine, 1982). *Guarded* means strict overexposure surveillance for possible harmful effects and *graduated* means systematic exposure increase to condition body to increased doses.

The authors, strongly, advocate that the most natural, the cheapest and the safest way is to expose skins of preteen male gymnasts to sunshine, at those times when sunrays are inclined and coming from a denser layer of atmosphere, so that intensity is reduced and harmful rays are cut down by absorption or removal from the main beam (Rybicki & Lightman, 1979). However, the sun should be treated with respect (Brady, 1958). Initially, start with a 10-*minute* exposure, gradually, increasing to 20 and, later, to 30 *minutes*, accompanied with 2-3-*hour*, fresh-air exposure in the shade. As there are no known risks associated with the air-exposure practice, the duration of this activity may be increased. During the initial sun exposure the authors recommend that gymnasts cover their exposed body-parts by an appropriate SPF (Sun-Protection Formula) sunscreen. The gymnasts should be minimally dressed, exposing hair, hands, arms, shoulders, backbone and back skin from external auditory meatus to waistline, legs from mid-thighs to feet. During this period, engage gymnasts in light floor activities, involving drawing, singing, scribbling, playing jigsaw puzzles or board games (*e. g.*, ludo), *etc.* Story reading / telling by teacher may form a structured activity. During an outdoor activity, the teac-

her should sit facing the sun and the students must have their backs towards the sun to protect their eyes (Kamal & Khan, 2014).

The importance of skin exposure of these gymnasts to the morning (for the morning-shift schools) or the later-afternoon (for the afternoon-shift schools) sun cannot be over-emphasised. A mirror exercise is needed by parents, whereby they should allow the boys to play in the sun stripped to waist, wearing only shorts/trousers in the later afternoon (for the morning-shift schools) or the morning (for the afternoon-shift schools). These dressing practices would, also, give the body an opportunity to breathe. Figure-3 summarizes these ideas.

Figure-3:
Vitamin-D deficiency: Some facts and remedial measures—adapted from Box-2 of Kamal & Khan (2014)

According to *Consensus Report of the Institute of Medicine* (November 30, 2010), recommended daily dose is 600 IU.
13 out of 14 cases were discovered in the Asian children — *UK Study*
Supplementation via intra-muscular injection, tablets or syrups fails to absorb at times and may cause severe vitamin-D toxicity.
The safest, the most natural and the cheapest way is to expose boys' skins to sunshine, at times when sunrays are inclined and coming from denser atmosphere.
For guarded-graduated sun exposure, initiate with a 10-*minute* exposure to boys' bodies, gradually increasing to 20-30 *minutes*, combined with 2-3 *hour* (or even more during summer) fresh-air exposure.
During initial contact with rays of sun, apply appropriate SPF sunscreen to the uncovered body-parts of boys.
Boys should be dressed in briefs only, stripped-to-waist, barefooted and bareheaded for sun treatment.
Boys should have their backs towards the sun to protect their eyes.

PRETEEN MALE GYMNASTS AND VITAMIN-D DEFICIENCY

Primary-school instruction in gymnastics is based on aesthetic, cognitive, creative, physical, psychological and skill components, with or without use of apparatus (Caroll & Manners, 2003). Gymnastics is a sport, which relies on human-body-physiological functioning, so that there is an all-round harmonious development of human body (Joseph, 1949). This sports being a show of strength, speed, coördination, balance and agility, requires concentration, flexib-

ility and devotion. Vitamin-D deficiency in gymnasts would affect severely their performance on various apparatuses, as their bones would not be supporting their bodies for the optimal technique, variability and control required for this sport (Hiley & Yeadon, 2015).

Integration of Remedial Measures in Gymnastic-School Setup

Figure-4 outlines the routine of a typical day of a gender-segregated-gymnastic school suggested by the authors.

Morning Inspection

There should be a morning inspection, covering safety and security, mental and physical health as well as cleanliness and hygiene. The first one should focus on absence of communicable diseases (for example, infections, skin problems), whereas the second one is conducted for the purpose of uncovering any form of abuse (verbal, physical, sexual), peer pressure / bullying (any unexplained bruises or cuts should be investigated), neglect and tendencies to destructive / suicidal behavior (Kamal & Khan, 2014) as well as spotting signs and symptoms of depression or schizophrenia (Kamal & Jamil, 2012) supplemented by remote video-monitoring of behavior by educational psychologists. The hygiene portion of inspection should be devoted to looking for cleanliness related to hair, mainly checking for lice, nails, uniform, shoes, vest, underwear and socks as well as a thorough inspection of feet (Kamal *et al.*, 2011*b*). Those presenting with the slightest deviations from normal health statuses (class teacher should compare current-day heath-status with the last seven entries to spot unusual findings) should be sent to school doctor for a complete examination (with the student undressed), before allowed mixing with other students. Unclothed- morning-inspection practices are common in Russian crèches, which are headed by doctors. There are, also, indications that selected schools in Asia, Europe and North America have adopted these practices. Visits to doctor shall be reduced if drills are arranged to reinforce practice of hand washing after activity programs, before and after eating and after

responding to call of nature. Summary of morning inspections is available in Table-1 and details may be found in Kamal & Khan (2014). It would be best if the initial activity of school day were based on light gymnastic-exercises outdoors. As the students would be undressed for these activities, the morning inspection could be carried out smoothly.

Figure-4:
Typical routine of a day scholar at a gymnastic school — adapted from Figure-2*a* of Kamal & Khan (2015)

No food or drink 1.5 *hour* before the start of a gymnastic session.

Upon arrival, boys are given morning inspection, stripped to short underpants, barefooted, all clothing above the waist removed — safety, hygiene and health (physical and mental) components; clothing worn from home stored in locker after security-check (hand-held detector).

Setting-up exercises, followed by light floor and structured activities, are performed in open air and sunshine so that the students get their required daily doses of vitamin D.

During the above activities, boys should have hair exposed, completely undressed except briefs, barefoot, having backs toward the sun to protect eyes.

Complete change of clothes for classroom lessons, gymnastic sessions and rest sessions.

End-of-class exercises performed for 5 *minutes*.

For gymnastic sessions, boys change into prescribed kit for their respective age groups.

Pre-departure inspection and handing over students to their parents.

Table-1:
Morning inspection to check for health statuses (mental and physical)$^{\Sigma}$, hygiene, safety and security considerations — preteen male gymnasts stripped to short underpants for this inspection$^{\oplus}$

Inspection Component	*Description*
Safety$^{\Phi}$ and Security$^{\circledR}$	Main purpose is to stop import of controlled substances: illegal drugs, pointed/sharp objects and all types of weapons, (canine teams, observers, mandatory hand searching of school bags and clothing, sending carryon baggage through X-ray machine — shoes, clothes and other personal items carried close to body should not be X rayed)
Mental Health	Prime purpose is to spot depression, neglect, peer pressure, verbal abuse, schizophrenia, signs and symptoms of destructive behavior (video-monitoring from another room by educational psychologists)
Physical Health	General purpose is to pinpoint communicable diseases (*e. g.*, infections, skin problems), signs of bullying/physical abuse (documentation as well as detailed questioning and investigation of unexplained bruises or cuts$^{=}$)
Hygiene	Inspection should include general appearance, very short hair (for presence of lice), nails (clean and cut short), shoes (polished or not), socks (clean/non smelly), tidiness, uniform (clean and properly ironed), underwear, vest as well as thorough inspection of feet, on particular, between toes (for presence of fungus infection)

$^{\Sigma}$The students, who show slightest deviation from normal health statuses (physical and mental), all new entrants to school and those reporting from sick leave should be examined completely by the school doctors as well as evaluated by the school psychologists before being allowed to

mix with the other students (Kamal *et al.*, 2017*b*).

[⊕] Adapted from Table-3 of Kamal & Khan (2014)

[Φ] Logbook should be maintained to enter students' arrival and departure. as well as anything found in the morning inspection (to, legally, protect school authorities). Any unusual findings should be entered in student's diary and explanation sought from parents. Parents should be required to enter similar timings in the diary, so that any extra time spent by students during traveling is monitored. In case of an unauthorized absence, school authorities should call parents to rule out the possibility that a child left for school but did not reach there. Effective surveillance is the key to spotting internal injuries, possible abuse and may prevent student abductions en route to school or while going back home.

[®] Has taken center-stage in the wake of shooting spree by gun-holding individuals in the Marjory Stoneman Douglas High School, Parkland, Florida, United States (2018) and the Sandy Hook Elementary School, Newton, Connecticut, United States (2012), terrorist attack in the Army Public School and College, Peshawar, Khyber Pakhtunkhwa, Pakistan (2014) as well as terrorist take over in School Number One, Baslan, North Ossetia-Alania, Russia (2004) — the authors recommend that the person and the belongings of all newcomers (prospective parents, prospective students, persons bringing in deliveries/providing services or doing repairs, individuals/groups from any institution/agency) should be checked before they are allowed to enter the school premises.

[Ξ] School physician must conduct a complete, unclothed examination of any student reporting for even a minor cut or bruise to rule out damages and abrasions to other parts of body as well as internal injuries — mandatory for safety of students and legal protection of school/club.

Table-2:
Exercise plans for preteen male gymnasts[Ω]

Exercise Name	*Description*
For the following, all boys strip to waist	
Setting-up exercises (at the start of school day)	Stretching hands (palms together) to front and top of head (stretching body by standing on toes), reaching to toes such that knees are not flexed, exercising to relax neck muscles (chin up, chin down, neck turned to left and right at an angle of 90 degrees)
End-of-class exercises (for 5-*minute* duration)	Stretching, bending sideways, bending to touch toes with knees extended, moving head up and down, rotating neck on both sides so that the respective chin is aligned with shoulder
For the following, younger boys strip to briefs; older to figure-hugging half pants[¶]	
Exercises to increase height (for stunted[ɜ] students)	Light-stretching exercises (bar hanging, mild stretching, summersault, cartwheel) — diet plan[©] should include calcium-, protein- and fiber-rich diet
Exercises to gain weight (for wasted[∀] students)	Heavy exercises performed for shorter duration, consistently — diet plan[©] should include milk, potato items and protein-rich diet (meat, fish)
Exercises to lose weight (for obese[∃] students)	Light exercises performed for longer duration, consistently — diet plan[©] should include salad and yogurt

[Ω] Adapted from Table-2 of Kamal & Khan (2014). All these exercise should be performed outdoors, weather perm-itting — setting-up exercises with the students' backs towards the sun, all of the other set of exercises in the shade of trees.

[¶] All clothing above the waist removed, barefoot indoors, sneakers (plimsolls) outdoors.

[ɜ] Lesser height-for-age (below 50th percentile of height; our group defines

stunting as height lesser than current-age-mid-parental height).

∀. Lesser weight for-height ;(percentile of mass lesser than percentile of height).

∃ Excess weight-for-height ;(percentile of mass greater than percentile of height).

©. All diet-based interventions would be ineffective if the student is suffering from vitamin-D deficiency.

Table-2 lists exercise routine for students in the gymnastic school, which include setting-up exercises, end-of-class exercises as well as exercises to pick-up height and put-on / shed-off weight, preferably, conducted outside in fresh air and, possibly, under the sun during moderate weather.

Attire for Gymnastic Activities

Age-appropriate hairstyle, footwear and clothing for preteen male gymnasts for instruction program of gymnastics, which is *efficient*, requiring the least amount of time spent in changing, as well as *effectiv*e, rendering quality instruction. Such a kit choice should allows the coach to view a gymnast's neck, shoulders, scapulae, body triangles, spinal dimples as well as spinal outline from external auditory meatus to hip joint without obstruction (Kamal & Khan, 2015). Gymnasts are given numbered boxes, in which they store their accessories for safekeeping.

Boys should have very short hair. They should do gymnastics barefoot, indoors as well as outdoors. Where barefoot is not possible during outdoor gymnastic activities, the students should wear white sneakers with white cotton socks. Disinfectant powder needs to be applied before putting on socks.

Children's attire during physical activity is being discussed for a long time (Curtis, 1922). Gym kit should not be loose enough to prevent the garment from getting caught into equipment, furnishings or fixtures. During headstand and summersault, baggy attire and loose garments (*e. g.*, T-shirt) may come over faces of gymnasts, obstructing vision and causing acidents. Further, gym clothing should not have loose strings or straps. Loose garments, strings or straps may get tangled into asymmetric bars or vault. Zippers are, also, not allowed, as these items damage apparatus. On the other hand, gym outfit should, also, not be

too tight (at the waist and around thighs), prohibiting free movement as well as heating / irritation of genital areas. Gym apparel should be white / light-coloured having elastic bands at waistline / around thighs, good enough to hold the garment in place and prevent private-part exposure.

The items, which are prohibited during gymnastic lessons include belt, bow, cap, chain, dress shoes, (silky) gym clothing, locket, rings, shirt, shorts, socks (made of synthetic material), street shoes, T-shirt, tie, trousers, vest and watch (Figure-5). Preteen gymnasts get heated, quickly. Committee on Sports Medicine of the American Academy of Pediatrics (1982) proposed, "Clothing of exercising child should be lightweight, limited to one layer of absorbent material in order to facilitate evaporation of sweat and *expose as much skin as possible*." Hence, the authors suggest that younger students exercise in minimal clothing. The benefits include**:**

a) The gymnasts get their vitamin-D doses from air and sun exposure during the outdoor exercises, performed in secluded grassy patches.
b) Minimal attire makes the coach aware of obese / wasted gymnasts.
c) The gymnasts would be compelled to maintain balan-ced gait and improved body image if they have to wear this kit.
d) It gives the coach a chance to observe unconscious posture and free movement.
e) Gymnasts in this age group grow rapidly; fitting clothing, purchased at the beginning of school year, becomes tight quickly. Loose clothing looks shabby, besides being unsafe for apparatus activities.
f) Gym kit kept on during the entire activity does not allow body to breathe, becomes sweat-soaked, causing skin infections, irritations and tan lines on shoulders / arms.
g) During mud/water/sand activities, upper portion of kit gets damp and dirty.

Table-3:
Recommended hairstyle, footwear and clothing for training and public-performance sessions of preteen male gymnasts[⊗]

Setting	*Training Session*	*Public-Performance Session*
Hairstyle[€]		
Indoors	Very short hair	Very short hair
Outdoors	Very short hair	Very short hair
Footwear[€]		
Indoors	Barefoot	Barefoot
Outdoors	Pure-cotton socks + sneakers (plimsolls)	Pure-cotton socks + sneakers plimsolls)
Clothing[π]		
Under 7		
Indoors	Briefs[∅]	Briefs[∅]
	Briefs[μ]	Briefs[μ]
	Briefs[θ]	Briefs[θ]
Outdoors	During colder weather, coats/sweater to be worn for warn-up and cool-down activities	
Under 9		
Indoors	Briefs[∅]	Briefs[∅]
	Briefs[μ]	Briefs[μ]
	Briefs[θ]	Briefs[θ]
Outdoors	During colder weather, coats/sweater to be worn for warn-up and cool-down activities	
Under 11		
Indoors	Briefs[∅]	Figure-hugging half-pants[∅]
	Briefs[μ]	Figure-hugging half-pants[μ]
	Figure-hugging half-pants[θ]	Figure-hugging half-pants[θ]
Outdoors	During colder weather, coats/sweater to be worn for warn-up and cool-down activities	
11+		
Indoors	Figure hugging half-pants[∅]	Figure hugging half-pants[∅]
	Figure hugging half-pants[μ]	Figure hugging half-pants[μ]
	Figure hugging half-pants[θ]	Figure hugging half-pants[θ]
Outdoors	During colder weather, coats/sweater to be worn for warn-up and cool-down activities	

[⊗] Adapted from Tables-1 & -2 of Kamal & Khan (2015).
[€]. For all ages
[π]. Gymnastic teams and classroom sections should be formed according to build (Kamal, 2015*c*). The later is recommended to allow students to switch seating during middle of class — front-of-classroom students sent to back and vice versa.
[∅]. For 'small build' (brain dominating body: good for analytical/mental tasks) — sum of scaled percentiles of height and mass less than 50; scaled percentiles are obtained by mapping 40th CDC percentile to 50th scaled percentile; 0 is mapped to 0 and 100 to 100 (Kamal & Khan, 2015; Kamal *et al.*, 2017*b*).
[μ]. For 'medium build' (equal contribution of brain and body)—sum of scaled percentiles of height and mass equal to or more than 50, but less than 150.
[θ]. For 'big build' (body dominating brain: good for tasks involving strength and power) — sum of scaled percentiles of height and mass equal to or more than 150, but less than 200.

Other arguments may be seen in Kamal & Khan (2015). Table-3 lists recommended kit for training and public-performance sessions of preteen male gymnasts.

Attire in Classrooms

The first author proposed earlier that classroom sessions should, also, be formed according to build to allow students to switch seating during middle of class—front-of-clas-

sroom students sent to back and vice versa. This would serve the purpose of breaking mischief groups and allowing the students opportunity to make new friends. Further, students having big build (body dominating brain) would not be forced to sit on the backbenches all the time and every time compared for classroom performance with students having small build (brain dominating body)— the later already smart due to their anatomical and physiological structure at the same time receiving maximum attention from teachers, who teach generally from the front of classroom, provide passive motivation to big-build students, in this set-up, to (physically) bully small-build students (Kamal, 2015*c*). In the professional training programs for mature audiences, switching of seats during the middle of a session is standard practice.

Keeping students attired in long-sleeved shirts and neckties all weak long does not increase productivity, in particular, during, hot and humid season, with occasional absence of electricity in this country (fans stopped). The authors suggest that in a 5-*day* week, preteen male gymnasts dress in T-shirts, no undershirt/vest, for 3 *days*, formal dress, long-sleeved shirt, tie and jacket, for 1 *day* (used for formal presentations by students) and remain stripped-to-waist for 1 *day*, allowing their skins to breathe — the last dressing pattern increased to 3 *days* (leaving only 1 *day* to be clad in T-shirts) for gymnasts exhibiting vitamin-D deficiency, above threshold cumulative-scoliosis-risk weightage (Kamal *et al.*, 2013*f*; 2015*b*) and normalized-scoliosis-risk weightage (Kamal *et al.*, 2016*d*). It would be interesting to document the students' creativity, productivity and adherence to school discipline during these three dressing periods. If the educational philosophies of the Nikitin family in the suburb of Moscow, Russia and the authorities of the Hikari Kindergarten in Tokyo, Japan are valid (children in both these setups remain uncovered from the waist up, all year long, even going outside to

play in the snow), the above-mentioned indicators should be maximum for those days, during which the gymnasts remain stripped-to-waist, followed by those days, when the gymnasts wear light T-shirts.

Mandatory Vitamin-D Deficiency Testing during Physical Examinations

The authors recommend testing of vitamin-D deficiency during pre-participation and end-of-the-term physical examinations, which are described below**:**

Pre-Participation Physical Examination

This comprehensive psychological, physical and motor examination combined with fitness testing (Kamal & Khan, 2013) should concentrate on safety considerations of the potential gymnasts, their teammates, their coaches and the gymnastic school/club staff (Kamal *et al.*, 2017*b*). Its purpose is set to bring into light conditions, which may cause serious injury and harm during gymnastic routines, *e. g.*, cardiac problems, epilepsy, hernia or hydro seal, acute malnutrition (Kamal, 2015*a*) as well as conditions, which may be corrected, *e. g.*, knees joining/knees knocking and excessive obesity (Kamal, 2015*b*; 2017*b*). Main emphasis should be on detection of communicable diseases, in particular, skin problems, evaluation of sight and hearing (severe impairment may render the gymnast vulnerable to accidents) as well as presence of acute malnutrition, fatigue and psychological disorders. Gymnasts must be barefoot, undressed to briefs, all clothing above the waist removed, in the beginning. Underwear must be removed for genital (puberty rating, signs of sexual abuse, venereal diseases), orthopedic (posture, gait, presence of trunk deformities, cerebral palsy and rickets), nutritional-status (vitamin-D deficiency, signs of neglect, classifycation as under nutrition, overnutrition, energy chanennelization I-III) and skin (signs of physical abuse, presence of skin cancers) examinations. For classification of nutritional status, please see Kamal (2015*a*). Net mass (mass with no clothing worn) could, also, be taken during this segment. These segments should be grouped togeth-

er to reduce time for the gymnast to remain totally disrobed. Information on abnormalities detected should be provided to gymnastic coaches, class teachers and parents. Table-4 lists appropriate hairstyle, footwear and clothing for free play and observation, psychological testing, physical examination and fitness testing of gymnasts.

Table-4:
Hairstyle, footwear and clothing for free play and observation, psychological testing, physical examination[γ] and fitness testing of preteen male gymnasts

Session	Preteen Male Gymnasts
Hairstyle	
Free Play and Observation[η]	Very short hair
Psychological Testing	Very short hair
Physical Examination	Very short hair
Fitness Testing	Very short hair
Footwear	
Free Play and Observation	White pure-cotton socks + black pure-leather (mocation) shoes with foot support[ν]
Psychological Testing	White pure-cotton socks + black pure-leather (mocation) shoes with foot support
Physical Examination	Barefoot
Fitness Testing	Barefoot
Clothing	
Free Play and Observation	*Younger*: Vest[ρ] and shorts (with briefs) *Older*: T-shirt[ρ] and trousers (with briefs)
Psychological Testing	*Younger*: Shorts with briefs, stripped-to-waist[λ] *Older*: Trousers with briefs, stripped-to-waist
Physical Examination	White[⊇] briefs only, legs exposed from upper thighs to feet, stripped-to-waist
Fitness Testing	White[⊇] briefs only, legs exposed from upper thighs to feet, stripped-to-waist

[γ].Should include testing for vitamin-D deficiency.

[η] Gymnast is observed unaware for 10 *minutes* for social interaction with parent(s) and other .children.

[ν] Disinfectant powder is to be applied between toe and thumb as well as between toes before .wearing clean socks on dry feet.

[ρ] Absolutely nothing is to be worn under vest or T-shirt, which must be put on only dry skin. .Disinfectant powder is to be .applied on dry skin before wearing underpants.

[λ] Passive observation of posture and gait (with shoes on), concentrating on upper torso, is .conducted .during walking, standing (free speech), sitting (on chair/free writing), sitting (on .floor/working on .jigsaw puzzle) and drawing various figures (self, family) on whiteboard in tthis segment of examination.

[⊇] White color is needed to conduct moiré and raster examinations (Kamal & Khan, 2015).

End-of-the-Term Physical Examination

This should integrate psychological testing with physical examination combined with fitness testing, with gymnasts completely stripped except underwear, of course with nothing on above the waist. It should be, mainly, based on performance considerations and improvements

achieved compared to previous term as well as psychological disorders, *e. g.*, trends of anorexia and bulimia (Alexescu *et al.*, 2014).

In both of the above health appraisals, heights, masses (weights) and mid-upper-arm circumferences of gymnasts should be recorded using enhanced anthropometric instruments, capable to record heights and masses to least counts of 0.005 *cm* and 0.005 *kg*, respectively (Kamal *et al.*, 2016*b*), according to laid-down protocols (Kamal, 2006; 2017*a*; *c* — Additional File 2; Kamal *et al.*, 2013*e*) by reproducible measurers (Kamal and Razzaq, 2014). Recorded heights and masses should be used to assign build of gymnasts (Kamal & Khan, 2015) using scaled percentiles suitable for the Pakistani population (Kamal *et al.*, 2017*b*), compute estimated adult-height (Kamal *et al.*, 2017*a*; Malina & Bielicki, 1996), so that those planning to serve in the Armed Forces of Pakistan, may plan their exercise routines, accordingly, and generate Growth-and-Obesity Profiles (Kamal *et al.*, 2011) as well as Growth-and-Obesity Vector-Roadmaps (Kamal, 2017*c*; Kamal *et al.*, 2016*a*) of gymnasts using mathematical tools (Kamal, 2008; 2014) and employing enhanced growth charts, with height and mass values in the range — 0.01^{th} percentile to 99.99^{th} percentile (Kamal & Jamil, 2014). End-of-the-Term Evaluation should, also, include a detailed examination of posture (Kamal, 1996) and gait**:** walking (normal — mainly, looking for arm-swing asymmetry, limp and spastic gait; on heels; on toes; heal-to-toe; with book on head) and running (Kamal *et al.*, 1996; 2016*c*), including meticulous examination of feet (Kamal *et al.*, 2011*a*). There should be emphasis on screening for skeletal deformities, in particular, scoliosis, preferably using moiré fringe topography (Akram and Kamal, 1991; Kamal *et al.*, 2015*b*) and rasterstereography (Kamal *et al.*, 2016*d*) during the preteen years (later-childhood years). The examinations, which require removal of underwear, should not be conducted in the presence of other gymnasts.

Conclusion and Reccommondations:

Vitamin-D deficiency combined with inability of bones to absorb iron and calcium is approaching an epidemic among younger population. Lack of outdoor physical activities, excessive screen time (TV, computer, cell phone, *etc*.) and use of carbonated dinks are some of the factors contributing to this state of affairs. The nation must rise up to this challenge by mandating soft-drink producers to print detailed warning of their bottles / cans of the adverse effects of their products, as is the practice for all cigarette brands. In addition, students should be asked to go outdoors more often, may for 10 *minutes* after every 2 sessions of 45-*minute* each and perform light exercises in the sun, eyes should be protectted by sun glasses. They should be encouraged to consume sun rip fruits and vegetables as snacks instead of bakery items. Screen time should be limited to 1 *hour* during the entire day (half-an-*hour* for TV, half-an-*hour* for computer / tablet). Teachers should be trained to spot vitamin-D deficiency in their morning inspections. Those showing vitamin-D deficiency after laboratory tests should be put in specialized programs to overcome the problem. As all diet-based interventions to increase height and maintain weight are ineffective in the presence of vitamin-D deficiency, gymnasts would not be able to attain their full growth potential if they are suffering from this deficiency. A robust and progressive gymnastic program to produce Olympic-level gymnasts in our country could not be materialized if such drastic measures to overcome vitamin-D deficiency in preteen male gymnasts are not taken.

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