Indian J Pediatr (September 2014) 81(Suppl 1):S17–S22
DOI 10.1007/s12098-014-1465-9

REVIEW ARTICLE

Types of Food and Nutrient Intake in India: A Literature Review

Maria Gabriella Vecchio · Elizabeth Cherian Paramesh · Haralappa Paramesh · Claudia Loganes · Simonetta Ballali · Claudia Elena Gafare · Elvira Verduci · Achal Gulati

Received: 27 March 2014 / Accepted: 17 April 2014 / Published online: 15 June 2014

Abstract Nowadays India is undergoing an impressive economic growth accompanied by a very slow decline, almost stagnation, in malnutrition levels. In developing countries, studies on dietary patterns and their relationship with nutritional status are scarce. Over the years some nutritional studies have been performed to explore different types of food consumed in various Indian regions, among different social samples. The aim of the present paper is to review and describe trends in food and nutrition intake patterns in the different states of India. The review was carried out in PubMed, using the advanced research criteria: [food* OR ("meal pattern*") OR ("eating pattern*")] AND ("nutrient intake") AND India*. PubMed research gave back 84 results and out of these, 7 papers due to their focus on food intake and consumption levels in India have been included in this study. Food intake patterns showed that most of the Indians are vegetarians and that food items rich in micronutrients (pulses, other vegetables, fruits, nuts, oilseeds and animal foods) are generally consumed less frequently. Poor and monotonous cereals-based diet may promote inadequate nutrition intakes according to Recommended Daily Allowance (RDA) standards.

Keywords Food intake · Survey · Review · Children and adolescents · India

M. G. Vecchio · S. Ballali
ZETA Research Ltd, Trieste, Italy

E. C. Paramesh · H. Paramesh
College of Nursing, Lakeside Institute of Child Health, Lakeside Hospital, Bangalore, India

C. Loganes
Institute for Maternal and Child Health - IRCCS Burlo Garofolo, Trieste, Italy

C. E. Gafare
Department of Nutrition, University of Buenos Aires and Food and Diet Therapy Service, Acute General Hospital Juan A. Fernández, Buenos Aires, Argentina

E. Verduci
Department of Pediatrics, San Paolo Hospital and University of Milano, Milan, Italy

A. Gulati (✉)
Department of Otorhinolaryngology (ENT), Maulana Azad Medical College, Bahadur Shah Zafar Marg, New Delhi 110002, India
e-mail: achalgulati@rediffmail.com

Introduction

Health and nutrition are the most important contributory factors for human development. Countries, undergoing an economic transition, such as nations emerging in the international marketing competition, have to face new challenges in the treatment of nutrition related problems.

Nowadays India is passing through an impressive economic growth, accompanied by a very slow decline, almost stagnation, in malnutrition levels [1]. Malnutrition in India is not a child specific problem but it is prevalent in every age group and its adverse effects consist of greater susceptibility to infections, increased morbidity and mortality, enhancing decreased productivity and lower quality standards along all stages of life-evolution [2]. Adequate intake of food and regular nutrition habits are the major contributing factors for the maintenance of general health status.

India's poli-geographic terrain [3, 4] and pluralistic cultural background [5], offers a high variety of alimentary differences, like cereals, pulses, vegetables, fruits, milk and milk products, including also categories of minor national consumption, like meat and poultry, roots and tubers, fats, nuts and oils.

Cereals are the most economic source of energy, representing, therefore, the principal aliment for low income social classes [6]. Fruits and vegetables, though occupying about 65 % of cultivatable terrain, are consumed less frequently in India's general population [7], even if a regular intake of these aliments is recognized as an important health promoter, reducing prevalence of cardiovascular disease and obesity significantly [8, 9]. Milk and dairy products from animal sources (cow's milk or buffalo's milk) are an important part of Indian diet, and India has indisputably one of world's greatest milk and milk product producers. Furthermore diets rich in milk, cheese, yogurt and similar products provide important vitamins and minerals essential for human growth and development [10]. The beneficial health effects obtained from milk are mandatory for human body and help in prevention of chronic ailments [11].

Constant monitoring of nutrition habits and dietary intake, involving also families and communities in informative campaigns, ensures healthy balanced diets and therefore improvement of life-quality. Such initiatives offer efficient preventive strategies against the rise of non-communicable diseases, such as diabetes, coronary diseases and overweight [12].

India, with regard to massive changes on a socio-economic level, has to face new epidemics, despite problems related to under-nutrition, such as a progressively increasing rate of over-nutrition. As a consequence, the rise of disorders, traditionally perceived as western culture-driven, is emerging as a significant issue [13–15], especially in urban areas [16], where also cases of diabetes mellitus and coronary heart disease are becoming more frequent than in rural contexts [17, 18]. Overall, prevalence of overweight/obesity results to be higher among women (10.9 %) compared to men (7.8 %) [19, 20]. Such gender related differences, however, are due to a social family structure where women are commonly relegated within intra-domestic activities, featuring a prevalent sedentary life. Such a condition of inactivity contributes as an increasing risk factor to the accumulating of fat deposals. This data has been confirmed by researches conducted in different Indian regions [14, 21] and moreover in other South-Asian realities [22].

In developing countries, however, studies about dietary patterns and their relationship with nutritional status are scarce [23].

Aim of this paper, therefore, consists in reviewing existing literature, focused on most common trends in food consumption and energy intake, across the different regions of India.

Material and Methods

PubMed was searched for publications from 2002 and 2012 using the keywords: [food* OR ("meal pattern*") OR ("eating pattern*")] AND ("nutrient intake") AND India*.

Moreover nutritional manuals and nutritional documents have been consulted, such as: i) Dietary Guidelines for Indians: A manual. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India; ii) Department of Women and Child Development. 1995–96. India Nutrition Profile. Government of India, New Delhi (http://wcd.nic.in/); iii) National Nutrition Monitoring Bureau (NNMB). 1979–2002. NNMB Reports: National Institute Of Nutrition, Hyderabad, India (http://www.nnmbindia.org/); iv) Indian Council of Medical Research. 2009, constituted important sources to retrieve existing literature. Furthermore "Nutrient requirements and recommended dietary allowances for Indians" as well as the "National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India" have been taken into consideration.

Inclusion criteria were survey study design, food consumption reported by food-groups which constitute a scientific and clinical reference for nutritionists and studies enrolling Indian population.

Results

The search gave back 84 results, 6 of them were reviews. Among the items evaluated, 21 were considered relevant to the subject, and eventually 7 papers were included in this study, because of their focus on food intake and consumption in India. Table 1 lists the included papers, featuring a brief description of the sample and the methods used to retrieve information on food consumption, and Table 2 reports the respective outcomes.

The retrieved studies reported the mean (g/day) or percentage of daily intake of food-groups among different Indian populations, both in rural and urban contexts. With regard to researches, using 24-h Recall Method and questionnaires, cereals and millets formed the bulk of dietaries in all states and selected samples, followed by vegetables, dairy products and others [23–29]. Within the review, therefore, articles have been chosen according to geographical areas taken into analysis, from north to south India, involving pre-school children, school aged kids and adolescents.

Pre-school age is considered as a dynamic period of growth and development, where children undergo physical, mental and emotional development. Adequate food intake results being the most important requisite granting for healthful development [24]. But only 20.3 % of pre-school children are found nutritionally normal, while the others suffer from mild, moderate, or severe malnutrition [25]. This data revealed, that mean food and nutrient intake was lower than the Recommended Daily Allowance (RDA). None of the food-groups analyzed across the papers satisfy the recommended values [26, 29].

Parvinder et al. [26], whose study is focused on feeding practices and dietary patterns of 9–36 mo old children in an

Table 1 Results of literature search

Title	Authors (ref)	Sample	Regional area	Context	Method
Food and nutrient intake of pre-school children (2–6 y) of Sonepat district	Parvinder et al. [26]	Pre-school children (2–6 y) n=200	Sonepat, Haryana (North India)	Rural	24-Hour Recall Method
Dietary intake and growth pattern of children 9–36 mo of age in an urban slum in Delhi	Kapur et al. [27]	Children (9–36 mo) n=545	Delhi (North India)	Sub-urban	Food Frequency (FFQ) and Amount Questionnaire (FAQ)
Diet quality and nutritional status of rural adolescent girl beneficiaries of ICDS in north India	Malhotra and Passi [28]	Adolescent girls (11–21 y) n=209	New Delhi (North India)	Rural	24-Hour Recall Method and FFQ
Prevalence of micronutrient deficiency based on results obtained from the national pilot	Chakravarty and Sinha [24]	Cross-regional population (4 - 60+ y) n=not given	Assam, Bihar, Orissa, West Bengal and Tripura (Northeastern and Eastern India)	Rural	Survey on dietary intake
Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations	Venkaiah et al. [23]	Adult population (18–80 y) n=6389	Orissa state (East India)	Rural	24-Hour Recall Method and Factor Analysis
Dietary adequacy of Indian rural preschool children-influencing factors	Lakshmi et al. [29]	Pre-school children (1–5 y) n=205	Mysore (South India)	Rural	24-Hour Recall Method and FFQ
Nutrition knowledge, attitude and practice of college sportsmen	Nazni and Vimala [25]	Athletes (19–24 y) n=102	Tamil Nadu (South India)	Urban and Sub-urban	Diet Recall and questionnaires

urban slum of Delhi, assessed energy intake levels through a ten-item questionnaire on frequency and amount of alimentary consumption. The results indicate that the mean intake of cereals, vegetables, fruits, fat and sugar was mostly inadequate, meeting only 43 %, 39 %, 28 %, 40 % and 56 % respectively of the recommendations for children aged 6–36 mo.

A cross-sectional study, carried out in New Delhi investigated diet quality and nutritional status of rural adolescent girls [28]. Mean daily intake of the subjects was compared with the suggested amounts of various food groups indicated for girls aged 13 to 15 y. According to this dietary study, adolescent girls consumed primarily cereals and milk as well as its related products. The mean daily intake of green leafy-vegetables and other vegetables, instead, ranges between 26 g and 34 g, compared to 100 g of the recommended values for each vegetable. The mean daily intake of fats/oils and fruits was lower than other food-products, reaching only 16 g and 3 g respectively, while the sugar consumption agrees with the suggested value (20 g/d). Data revealed that the mean daily intake of dairy products, green leafy-vegetables, other vegetables, fats/oils and fruits was highly unsatisfactory. Only that of fats/oils was approximately adequate, meeting 65 % of the recommended standards. Also, intake of cereals was almost adequate revealing a deficit of just 7 %.

The consumption of food has been evaluated according to regional differences, co-responsible in influencing and modifying dietary status. Accordantly, a survey conducted in five rural eastern states [24] – Assam, Bihar, Orissa, West Bengal and Tripura – evaluated, that although these contexts show different alimentary habits, all intake values were deficient for all food groups, except cereals. Consumption of cereals, indeed, was satisfactory except in Assam, where it fell short according to RDA parameters. Only 10.2 % satisfied the 460 g portion per day. Even if consumption of green leafy vegetables was generally adequate, in Orissa a deficient intake of 28.9 % with regard to RDA standards (50 g/d) has been recorded. The consumption rates of dairy products was lower than the respective RDA (50 –90 % of the RDA, 150 g/d) within households of all districts [18]. The mean intake of fats and oils, sugar and jaggery, fruits and nuts was deficient in most of the regions. The overall picture of this nutritional survey is that rural families consumed adequate or marginally satisfactory amounts of cereals and roots and tubers, but other food groups, namely pulses and legumes, fruits and nuts, animal food, and milk and milk products, fell far short according to RDA.

A recent survey always conducted in eastern India, (Orissa state) [23] analyzed the mean intake of rural populations,

Table 2 Summary of findings: mean daily food intake (grams) or percentage of daily food intake according to RDA standards

Study	Age group	Cereals & Millets		Pulses & Legumes		Green-leafy vegetables		Roots & Tubers		Milk & Milk products		Fruits		Fats/Oils		Sugar	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Parvinder et al. [26]	2–4 y	82.2 g	80.1 g	57.2 g	57 g	22.1 g	26.3 g	61.9 g	57.6 g	51.6 g	48.2 g	26.4 g	35.1 g	89.6 g	85.9 g	67.8 g	68.7 g
	4-6 y	91.7 g	92.1 g	43 g	40.7 g	22.8 g	24.8g	28.4 g	29 g	49.2 g	49.4 g	12.5 g	14.6 g	61.7 g	62.2 g	48 g	51.4 g
Kapur et al. [27]	9–36 mo	43 %		33 %		13 %		48 %		82 %		28 %		40 %		56 %	
Malhotra and Passi [28]	11–21 y	–	250 g 93 %	–	22 g 36 %	–	26 g 26 %	–	72 g 72 %	–	234 g 47 %	–	3 g 3 %	–	16 g 65 %	–	20 g 97 %
Chakravarty and Sinha [24]	4–60+ y	460 g		40 g		50 g		50 g		150 g		30 g		20 g		30 g	
Venkaiah et al. [23]	18–80 y	660.1 g	534.5 g	36.5 g	29.9 g	37.7 g	31.8 g	108.4 g	85.1 g	23.3 g	17.9 g	18.7 g	13.8 g	9.3 g	7.4 g	14.2 g	12.1 g
Lakshmi et al. [29]	1–3 y	116-158 g*	132-155 g	12-14 g	16-18 g	2 g	2-10 g	6-9 g	5-7 g	28-32 g	16-21 g	8-10 g	4-18 g	2-3 g	2-3 g	9-10 g	8-10 g
	4–6 y	157-207 g	161-225 g	17-22 g	15-23 g	2 g	1-9 g	2-9 g	13-15g	13-44 g	12-23 g	7-11 g	1-2 g	1-3 g	1-3 g	7-13 g	7-12.3 g
Nazni and Vimala [25]	19–24 y	340-348 g**		55-78 g		200-260 g		180-200 g		760-1400 g		300-410 g		60-67 g		55–80 g	

*The ranges are related to intake variation according to 3 seasons: Summer, Monsoon, Winter

**The ranges are related to intake variations according to 3 athletic categories: Volleyball players, Weight lifters, Runners

divided by gender. According to this study, the mean intake of cereals and millet of males and females is even higher than RDA values (460 g/d). Intake, instead, of green leafy-vegetables, dairy products, fruits, fats and oils, sugar and jaggery is reported to be lower than RDAs [30]. As expected, the mean of food intake for males is higher than that of the female populations [23].

A nutritional investigation was undertaken with the aim of assessing the dietary intake of rural pre-school children [29]. For this target, children between age of 1 and 5 y were selected from five rural regions near Mysore (southern India). Food intake was assessed in three different seasons (Summer, Monsoon and Winter) to observe seasonal variations. Findings revealed that diets were predominantly cereal based, while consumption of protective foods, such as milk and milk products, green leafy vegetables and fruits, were found to be negligible. Seasonality was observed only in the consumption of cereals and pulses (showing higher values during monsoon and winter seasons) but not in the consumption of vegetables or fruits. The mean intake of all food stuffs was below the national average. In all the seasons for both age groups, similar nutrition values have been reported if compared to those of southern India [17].

In southern India (Tamil Nadu) a dietary study has been performed, selecting specific adult samples. Nazni et al. [25] analyzed the nutrition attitudes and eating habits of sportsmen. All athletes belonging to different disciplines (volleyball, run and weight lift) present with lower cereals intake (about 340 g/d) than the 550 g/d consumption, recommended for sportsmen. The intake of vegetables and milk was low among all the participants (except milk intake of runners). Such data is confirmed also in consumption of fruits and vegetables, particularly indicated for those practicing high levels of physical activity [25]. Fat intake of athletes, instead, showed even higher than RDA, while the mean consumption of sugar depends on the specific type of sport being practiced [25].

Discussion

In India, food habits are strictly associated to symbolic signifiers, cultural peculiarities and different expressions of social identities. This complex system of interdependent climatic, geographical as well as traditional variables made India an enormous apparatus of food production, especially grains, cereals and greens. Moreover, Indian cuisine varies from region to region [24] and from season to season [29], reflecting the widespread cultural pluralism in this subcontinent, which became a unique blend of various cuisines across Asia and around the world [31].

Food plays a vital role in the growth of a nation, still in economic transition from underdeveloped country to post-industrialized reality [29]. Food requirements and suggested

dietary intakes, currently recommended by national and international organizations, are primarily intended for healthy normal growth during the rapid stages of development such as infancy and childhood, and to meet additional demands during pregnancy and lactation [32].

The publications taken into consideration by this review are heterogeneous in terms of study population since urban and rural contexts, low and middle-high income classes and different age groups are involved.

Nevertheless, this review provides evidence of poor state of nutrition among children and adults in India, following a monotonous and vegetarian diet [27]. Food intake described by dietary assessment methods, suggested that their diets were predominantly cereal based, rich in carbohydrates and poor in other nutritional elements [33]. Carbohydrates, indeed, constitutes among 60 and 70 % of Indian population's total energy intake [6]. Such a finding represents a countertrend according to general changes in eating habits on a global scale during the last 30 y, where consumption of carbohydrate based products decreased to about 7 % [34]. Such a condition, in contrast to general tendencies, reflects however a common situation among Indians of Asian origin, whose intake rates of carbohydrates and especially cereals results to be higher than in other ethnic groups living in this macro-cultural context [35]. The consumption, instead, of aliments rich in proteins, such as milk products as well as flesh foods and fibers contained in green leafy vegetables and fruits, were found to be negligible [28]. Their absence in Indian diet leads to micronutrient deficiencies, such as vitamins and iron, which are extremely needful in order to grant adequate alimentary intakes, promoting general wellbeing and health status. Such a nutrition lack may lead to increase in several diseases in children and early adulthood like greater risk of insulin resistance [36]. According to the survey conducted by Nazni et al. [25] on sportsmen revealed that consumption of fat based aliments is in line with increasing intake levels (6 %) worldwide [34].

In India and other developing countries, 80% of the population has dietary intakes below the RDA [37]. When observing dietary patterns of people living in rural areas it was observed that, except for green leafy vegetables, other dietary sources rich in vitamin A, iron, vitamin C, folic acid, and calcium did not satisfy the recommended standards [18]. In these contexts intake of pulses and legumes, containing proteins besides fibers and vitamins, remained almost unsatisfying, while the intake increased significantly in urban areas, mostly in the middle income classes [34]. Because of little or no intake of protein-rich food, above all in rural areas and amongst economically disadvantaged populations, the value of dietary intake results being less than average. Hence, protein deficiency occurs due to both, the quality and quantity of proteins consumed by this population [18].

Micronutrient deficiency is a serious public health problem in most developing countries. In India, iron deficiency, vitamin A deficiency, and iodine deficiency related disorders constitute topics of urgent interest for public health. According to Venkaiah et al. [23] the mean intake of iron, calcium, and riboflavin was lower in both, men and women selected for the survey, if compared to RDA [30]. Another study conducted within an Indian rural adolescent sample, observed that the average intakes of all nutrients were below the RDA parameters [38].

From the studies included within the review it also emerged how consumption of food varies, in relation to different regional and urban areas. The evaluation criteria are mainly focused on the frequency of consumption of certain alimentary categories which result to be associated to geographical peculiarities and climatic changes.

Analysis of dietary patterns may offer, therefore, benefits by educating general population towards more healthful and diversified eating habits. Such informative campaigns should be implemented by public health, in order to promote efficient and prescient resources for the prevention of dietary related diseases.

Study Limitations

This review has been carried out principally through the online data resource "PubMed", in order to line up the most recent developments in research about eating disorders in a strictly quantitative perspective. Further reviews should consider also contributions published in other scientific sectors, such as economies, anthropology and social sciences, adopting qualitative or combined methodologies, too. Different ontological approaches may enrich research on nutrition disorders in India by analyzing the symbolic, cultural and commercial structure of such an enormous context. Investigations should be focused, therefore, on the rapid changes this pluralistic macro-context is undergoing since the recent economic growth and the fast diffusion of technological mediated communication systems, promoting globalization and urbanization processes on a micro- and macro-social level.

Conclusions

All nutritional studies reported in this review, carried out with different methods, indicate that: i) most of the subjects (from children to adults) followed a monotonous and vegetarian diet, based on cereals; ii) dietary consumption and food expenditure vary across geographic areas (rural or urban) and cultural contexts; iii) food intake is almost lower than RDA, and this may lead to nutrient deficit, which singly or in combination have an important role in making the person (especially child) vulnerable to morbidity and mortality. Strategies and interventions must be therefore proposed to prevent and control micronutrient deficiencies.

Contributions MGV and AG: Designed the study; ECP, HP and CL: Wrote the manuscript; SB, CEG and EV: Retrieved and selected the literature; All authors contributed to results interpretation, read and approved the final manuscript. Dr. Dario Gregori, Unit of Biostatistics, Epidemiology and Public Health, Department of Cardiac, Thoracic and Vascular Sciences, University of Padua, Italy, will act as guarantor for this paper.

Conflict of Interest None.

Source of Funding This work is partially supported by an unrestricted grant from the Italian Ministry of Foreign Affairs, Directorate General for Country Promotion, and from Prochild ONLUS (Italy).

References

1. Haddad L. Lifting the Curse. Overcoming Persistent Under nutrition in India. IDS Bull. 2009;40:1–8.
2. Balaji LN, Dustagheer A. Nutrition scenario in India–implications for clinical practice. J Indian Med Assoc. 2000;98:536–8, 542.
3. Jason RA, Aitchison JC. Greater India. Earth Sci Rev. 2005;72:169–88.
4. Basak RK. Botanical Survey of India. An Account of its Establishment, Development and Activities. New Delhi: Botanical Survey of India; 1983.
5. Mantovani G. Exploring Borders. Understanding Culture and Psychology. London: Rootledge; 2000.
6. Misra A, Rastogi K, Joshi SR. Whole grains and health: perspective for Asian Indians. J Assoc Physicians India. 2009;57:155–62.
7. Aberoumand A. Preliminary assessment of nutritional value of plant-based diets in relation to human nutrients. Int J Food Sci Nutr. 2009;60(Suppl):155–62.
8. Slavin JL, Lloyd B. Health benefits of fruits and vegetables. Adv Nutr. 2012;3:506–16.
9. Van Duyn MA, Pivonka E. Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: selected literature. J Am Diet Assoc. 2000;100:1511–21.
10. APEDA. Agricultural and Processed Food Products Export Development Authority. New Delhi: Ministry of Commerce and Industry Government of India; 2014.
11. Nagpal R, Behare PV, Kumar M, Mohania D, Yadav M, Jain S, et al. Milk, milk products, and disease free health: an updated overview. Crit Rev Food Sci Nutr. 2012;52:321–33.
12. Taylor RW, McAuley KA, Barbezat W, Strong A, Williams SM, Mann JI. APPLE Project: 2-y findings of a community-based obesity prevention program in primary school age children. Am J Clin Nutr. 2007;86:735–42.
13. Singh RB, Beegom R, Mehta AS, Niaz MA, De AK, Mitra RK, et al. Social class, coronary risk factors and undernutrition, a double burden of diseases, in women during transition, in five Indian cities. Int J Cardiol. 1999;69:139–47.
14. Krishnan A, Shah B, Lal V, Shukla DK, Paul E, Kapoor SK. Prevalence of risk factors for non-communicable disease in a rural area of Faridabad district of Haryana. Indian J Public Health. 2008;52:117–24.
15. Daniel CR, Prabhakaran D, Kapur K, Graubard BI, Devasenapathy N, Ramakrishnan L, et al. A cross-sectional investigation of regional patterns of diet and cardio-metabolic risk in India. Nutr J. 2011;10:12.
16. NION. Dietary Guilines for Indians. A Manual. 2nd ed. Hyderabad: National Institute of Nutrition; 2010.
17. Mohan V, Mathur P, Deepa R, Deepa M, Shukla DK, Menon GR, et al. Urban rural differences in prevalence of self-reported diabetes in India–the WHO-ICMR Indian NCD risk factor surveillance. Diabetes Res Clin Pract. 2008;80:159–68.
18. Shah B, Mathur P. Surveillance of cardiovascular disease risk factors in India: the need & scope. Indian J Med Res. 2010;132:634–42.
19. Misra A, Singhal N, Khurana L. Obesity, the metabolic syndrome, and type 2 diabetes in developing countries: role of dietary fats and oils. J Am Coll Nutr. 2010;29:289S–301.
20. NNMB. Diet and Nutritional status of population and prevalence of Hypertension among adults in rural areas. Hyderabad: National Nutrition Monitoring Bureau; 2006.
21. Vaz M, Bharathi AV, Kurpad AV. "Exercising" but not active: implications for physical activity counselling. Natl Med J India. 2006;19:345.
22. Khuwaja AK, Kadir MM. Gender differences and clustering pattern of behavioural risk factors for chronic non-communicable diseases: community-based study from a developing country. Chronic Illn. 2010;6:163–70.
23. Venkaiah K, Brahmam GN, Vijayaraghavan K. Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations. J Health Popul Nutr. 2011;29:327–38.
24. Chakravarty I, Sinha RK. Prevalence of micronutrient deficiency based on results obtained from the national pilot program on control of micronutrient malnutrition. Nutr Rev. 2002;60:S53–8.
25. Nazni P, Vimala S. Nutrition knowledge, attitude and practice of college sportsmen. Asian J Sports Med. 2010;1:93–100.
26. Parvinder K, Dahiya S, Rana MK. Food and nutrient intake of pre-school children (2–6 year) of Sonepat district. J Dairying Fd Home Sci. 2007;26:141–6.
27. Kapur D, Sharma S, Agarwal KN. Dietary intake and growth pattern of children 9–36 mo of age in an urban slum in Delhi. Indian Pediatr. 2005;42:351–6.
28. Malhotra A, Passi SJ. Diet quality and nutritional status of rural adolescent girl beneficiaries of ICDS in north India. Asia Pac J Clin Nutr. 2007;16Suppl 1:8–16.
29. Lakshmi AJ, Khyrunnisa B, Saraswathi G, Jamuna P. Dietary adequacy of Indian rural preschool children–influencing factors. J Trop Pediatr. 2005;51:39–44.
30. NION. Nutrient requirements and recommended dietary allowances for Indians. Hyderabad: Indian Council of Medical Research; 2009.
31. Henderson CE. Culture and costumes in India. Westport: Greenwood Press; 2002.
32. Raghuvanshi RS, Singh R, Singh R. Nutritional composition of uncommon foods and their role in meeting micronutrient needs. Int J Food Sci Nutr. 2001;52:331–5.
33. Kaur M, Kaushal P, Sandhu KS. Studies on physicochemical and pasting properties of Taro (Colocasia esculenta L.) flour in comparison with a cereal, tuber and legume flour. J Food Sci Technol. 2013;50:94–100.
34. Misra A, Singhal N, Sivakumar B, Bhagat N, Jaiswal A, Khurana L. Nutrition transition in India: secular trends in dietary intake and their relationship to diet-related non-communicable diseases. J Diabetes. 2011;3:278–92.
35. Misra A, Vikram NK. Insulin resistance syndrome (metabolic syndrome) and obesity in Asian Indians: evidence and implications. Nutrition. 2004;20:482–91.
36. Kinra S. Rameshwar Sarma KV, Ghafoorunissa, Mendu VV, Ravikumar R, Mohan V, et al. Effect of integration of supplemental nutrition with public health programmes in pregnancy and early childhood on cardiovascular risk in rural Indian adolescents: long term follow-up of Hyderabad nutrition trial BMJ. 2008;337:a605.
37. Duran A, Khot A. Strengthening the health system to better confront noncommunicable diseases in India. Indian J Community Med. 2011;36 Suppl 1:S32–7.
38. Venkaiah K, Damayanti K, Nayak MU, Vijayaraghavan K. Diet and nutritional status of rural adolescents in India. Eur J Clin Nutr. 2002;56:1119–25.