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EDITORIAL

Evaluating the Journal's Quality: Methods and Tools

Increasing access to information and media made available large number of scientific publications. Nevertheless, the worth of findings needs to be cautiously evaluated before its application. Research findings published in different journals do not offer high quality with equal weight on evidences. Widespread availability of publications put pressure on readers to screen the journals and articles before these are utilized. Therefore, evaluating the quality of academic journals is becoming increasing important in research performance evaluation. In fact "The number does not matter, the quality does" concept is indispensable in scientific world. Understanding the methods and criteria for assessing journal quality is critical in determining the overall value of publications.

Evaluation methods such as peer review; impact factors and reputation of the journal are considered to be the hallmarks of journals. In addition to the traditional measures, journal ranking and article quality assessment are new techniques of evaluation of journal quality. Calculation of Eigenfactor score, SCImago Journal Rank (SJR), Article-Level Metrics and data citation index and; alternative matrices (altmetrics) like blogs, social media and some online systems are also in practice. Most common tools to measure journal impact are Journal Citation Report (JCR) and SCImago Journal Rank (SJR). Important evaluation methods are introduced here in this paper.

1. **Peer review:** It is the evaluation of work by one or more people with similar competences. It is commonly accepted as an essential part of scientific publication. It is often used to determine an academic paper's suitability for publication and to validate academic work. The review may be single blind, double blind and open review.
2. **Impact factors:** The impact factor (IF) is a measure of the frequency with which the average

article in a journal has been cited in a particular year. It is used to measure the importance of a journal by calculating the times its articles are cited. Calculation of IF is based on a two-year period and involves dividing the number of times articles were cited by the number of articles that are citable.

Journal Citation Reports provides ranking for journals in the areas of science, technology, and social sciences. Citation and article counts, Impact factor, Immediacy index, Cited half-life, citing half-life, source data listing, citing journal listing, cited journal listing, subject categories, publisher information are collected and counted in JCR. JCR includes two editions: the Science Edition and the Social Sciences Edition.

Eigenfactor score and Article Influence score: Like impact factor, the Eigenfactor score and Article Influence score use citation data to assess and track the influence of a journal in relation to other journals. The Eigenfactor score calculation is based on the number of times articles from the journal published in the past five years have been cited in the JCR year. The Article Influence determines the average influence of a journal's articles over the first five years after publication. It is calculated by dividing a journal's Eigenfactor Score by the number of articles in the journal. Thus, Eigenfactor scores are intended to give a measure of how likely a journal is to be used, and how frequently an average researcher would access content from that journal.

3. **SCImago Journal Rank (SJR):** SCImago Journal Rank is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from. It is the measure of scientific influence of scholarly journals contained in the Scopus database from 1996.

Difference between Impact factor and SCImago Journal Rank

The main difference between IF and SJR that the IF gives equal weight to all citations, making no distinction between citations published in some obscure journals and citations published in Nature or Lancet. To address this issue, SJR uses mathematical approach behind the Google's Page Rank algorithm and adapts it to journal metrics. The Page Rank model type weights citations from journals according to how highly cited the journal itself is.

Furthermore, impact factors are derived from citations in a single year to articles from the two preceding years whereas SJR looks at citations made in a three year period. This makes the SJR a more stable indicator of trends than impact factors, which often fluctuate substantially from year to year.

1. Other metrics

- 1. Google Scholar Metrics:** It provides an easy way for authors to quickly gauge the visibility and influence of recent articles in scholarly publications. It summarizes recent citations to many publications, to help authors as they consider where to publish their new research.
- 2. Article-Level Metrics (ALM):** Many other methods of measuring the impact of published articles involve metrics computed at the article or author level rather than the journal level. It demonstrates the impact of an individual article. Most important reason for article level assessment is to promote speed of feedback and superior relationship mapping and influence tracking of the article.
- 3. PLoS Article Level Metrics:** Since March 2009, PLOS introduced article level matrices for all articles including downloads, citations and altmetrics. These ALMs present the broad range of snapshots and cumulative information including HTML page views, PDS downloads, XML downloads Pub Med central usage, citations, Google scholars, Scopus, social

media like face book, twitter and blogs.

- 4. Scopus:** It is a large abstract and citation data base. The inclusion of ALMs expands the range of information that indexes traditionally. Data sources include social media sites such as twitter, face book, Pinterest and Google+ and scientific blogs; reference manager and bookmarking sites (e.g. mendlly, citeULike).
- 5. Alternative matrices (altmetrics):** Altmetrics are non-traditional bibliometrics to compliment traditional citation impacts. The term "altmetrics" was proposed in 2010, as a generalization of article level matrices. Altmetrics do not cover citation counts but calculate scholar impact based on diverse online research output, such as social media, online news media, and online reference managers. It demonstrates both the impact and the detailed composition of the impact.
- 6. ImpactStory:** It is an open-source altmetric tool. It draws from a variety of social and data sources, including Facebook, Twitter, CiteULike, Delicious, PubMed, Scopus, Cross Ref, scienceseecker, Mendeley, Wikipedia, slideshare, Dryad and figshare. It normalize metrics based on sample of article published in the same year. Impact Story offers a wide range of free widget to embed matrices on any web page.
- 7. Plum Analytics:** It is Seattle-based technology startup. It aims to track metrics for nearly two dozen outputs including journal articles, book chapters, data sets, presentations and course code. It provides customer reports intended to quantify productivity, support grant proposal and address impact related questions.
- 8. Data Citation Index (DCI):** DCI was introduced by Thomson Reuters in 2012 as a Single point of access to quality research data from repositories across disciplines and around the world. Data Citation Index is a searchable collection of data sets and data studies from a select list of repositories. DCI is intended to facilitate the discovery of data, link data to the

1. literature, and encourage citation of data. In this index, descriptive records are created for data objects and linked to literature articles in the *Web of Science*.

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Survey on Medicinal Plants used for Anti-diabetic Activity in Kaski District, Nepal

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ABSTRACT

Nepal is a Himalayan country with disproportionately rich cultural and ethnic diversity, recorded of over 700 species of medicinal plants. Most of the people in rural area rely on herbal medicines to treat diabetes mellitus since they have limited resources and do not have access to modern treatment. The main aim of the study was to search the medicinal plants used for diabetes mellitus for the development of evidence based medicine. The study was conducted in five different places of Kaski District, Nepal with two hundred numbers of respondents. It was found that majority of them had good knowledge on traditional use of the plants for diabetes and had been using 52 plant species of 35 families in which *Asparagus racemosus*, *Momordica charantia*, *Berberis aristata*, *Azadiracta indica*, *Holorhena pubences*, *Eugenia jambolana*, *Aegle marmelous* and *Gymnema sylvestre* are the most widely used plants for anti-diabetic purposes.

Key words: Diabetes Mellitus, Medicinal Plants, Kaski District, Survey, Respondents

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INTRODUCTION

Natural products have played an important role in the treatment of various diseases and in drug discovery processes for thousands of year. The ancient civilizations of the Chinese, Indians and North Africans provide written evidence for the use of natural sources for curing various diseases. It has remained a source of new compounds with diversified structural arrangements possessing interesting biological activities. The earliest known written document is a 4,000 year old Sumerian clay tablet that records remedies for various illnesses. For instance, mandrake was prescribed for pain relief, turmeric possesses blood clotting properties, roots of the endive plant were used for treatment of gall bladder disorders and raw garlic was prescribed for circulatory disorders. These are still being used in several countries as alternative medicines. Friedrich Sertürner isolated morphine from *Papaver somniferum* in 1806 and since then natural products have been extensively screened for their medicinal purposes. Atropine from *Atropa belladonna*, strychnine isolated from *Conus magus*, and Taxol obtained from the bark of the Pacific yew tree are a few examples of active isolated compounds from natural sources¹.

It is estimated that more than 25% of all current prescription drugs are derived from plants. Among the drugs developed over past 25 years, 5% were natural products, 27% were derivatives of natural products and 30% were synthetic drugs inspired by natural products. The most successful story of the discovery of the anti-diabetic drugs from natural products is metformin. Its parent compound is natural guanide originally purified from the plant *Galegine officinalis*².

Despite competition from other drug discovery methods, natural products are still providing their share of new clinical candidates and drugs. These compounds are still a significant source of new drugs, especially in the anticancer, antihypertensive, anti-infective, immune suppression and neurological disease therapeutic areas and some of them have since progressed further into clinical trials or into the market. Therefore, in addition to being a proven and important source of drug leads, natural products derived drugs also contribute significantly to the profitability of many companies. A natural product is a chemical compound or substance produced by a living organism found in nature that usually has

a biological activity for use in pharmaceutical drug discovery and drug design. A crude extract from natural product contains novel, structurally diverse chemical compounds. Not all natural products can be fully synthesized and many natural products have very complex structures that are too difficult and expensive to synthesize on an industrial scale. These include drugs such as penicillin, morphine and formerly paclitaxel. Such compounds can only be harvested from their natural source a process which can be tedious, time consuming, and expensive as well as being potentially unsustainable for the resource³.

Nepal is a Himalayan country with disproportionately rich cultural and ethnic diversity, lies in the temperate zone with an added advantage of altitude from 1220 to 8848 m above mean sea level, except for a few places that lie below 1220 m. The diversity of species in Nepalese flora offers great opportunities for the search of medicinal substances, not yet described or discovered. Nepal has a record of over 700 species of medicinal plants. There is a store of still unwritten and undocumented traditional knowledge on the use of plants for healing purposes. To sustain and perpetuate folk medicine systems to provide primary health care for the majority of inhabitants in the rural area, medicinal plants are bound to play pivotal role⁴.

Diabetes mellitus (DM) is considered as a major health risk in the world caused by the deficiency of effective insulin in the body. It causes the disturbance of metabolism of carbohydrate in body. This results in hyperglycemia (excessive sugar in the blood) and glycosurea (presence of sugar in the urine). Some other symptoms associated with disease are polydipsia (increased thirst), polyurea (increased urinary output), ketonemia and ketonurea (presence of ketone bodies in the blood and urine, respectively). As the disease progresses tissue or vascular damage ensues adding to severe diabetic complications such as retinopathy, nephropathy, neuropathy and ulceration, thus diabetes mellitus is a chronic and progressive conditions associated with serious micro vascular and macro vascular complications⁵.

WHO has listed 21,000 plants for medicinal purposes around the world. Among them, 800 plants

have been reported to show antidiabetic potential. The pharmacological actions of plant materials typically result from the combination of secondary metabolites present in the plant like polyphenols, flavonoids, alkaloids, tannins, saponins, volatile oils, etc. which are known as phytochemicals⁶. Phytochemicals exert their effect by resembling endogenous metabolites, ligands, hormones, signal transduction molecules or even neurotransmitters.

Most of the people in developing countries rely on herbal medicines to treat diabetes mellitus since they have limited resources and do not have access to modern treatment. Several compounds derived from these herbal medicines are in use for various kinds of disease and disorders. Another important factor that supports the use of plant materials as antidiabetic could be due to the belief that herbs provide some benefits over allopathic medicine and allow the users to take medications of their choice⁷. Therefore, the aim of the study was to search the medicinal plants used by local people for the treatment of diabetes.

MATERIALS AND METHODS

Study Area

Kaski District (83°40' east to 84°12' East longitude and 28°06' north to 28°36' North latitude) which is a historical and twenty third largest densely populated density district of the country was selected for the study. The total area of the district is 2017 sq.km. Different types of climate like sub-tropical, temperate, temperate cold, alpine and tundra is found in Kaski district. The Maximum rainfall was recorded as 701.7 mm in 2009 August and similarly, the maximum temperature was recorded 32°C in summer and 2.2°C in winter season. The temperature is always influenced with variation in altitude.

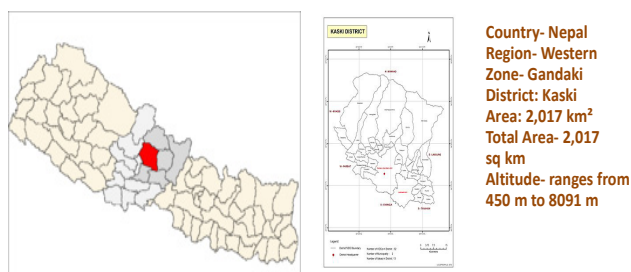


Figure 1: Location map of Kaski District Source: [http:// ganthan.com/kaski-district-map/](http://ganthan.com/kaski-district-map/)

Study Design

Survey was conducted to investigate anti-diabetic medicinal plants used by local people in Kaski District during different periods of year 2015-2016. 200 peoples from different five places (Gandruk, Hemja, Lamachour, Khudi and Kotre) were selected and information regarding the antidiabetic medicinal plants was collected through questionnaire and personal interviews. A verbal consent from the respondents was taken before the study.

RESULTS AND DISCUSSION

A list of plant species along with their local name, scientific name, family name, parts used and methods of uses is given below in Table 1. The investigation revealed 52 plant species belonging to 35 families are being used to cure diabetes. It was also found that people from any occupation and age above 25 years used medicinal plants to cure diabetes. In the local market of Kaski district it was found that major component of herbal and ayurvedic formulation for antidiabetic purposes being used were *Asparagus racemosus*, *Momordica charantia*, *Berberis aristata*, *Syzygium cumini*, *Aegle marmelous*, and *Gymnema sylvestre*. During survey, it was found that *Momordica charantia* (16%), *Asparagus racemosus* (14%), *Aegle marmelous* (13%), *Berberis aristata* (11%), *Holorhena pubences* (12%), *Eugenia jambolana* (12%), *Azadiracta indica* (12%) and *Gymnema sylvestre* (10%) were the most widely used plants for diabetics. These plants are consumed either in the form of juice, powder or boiled extract of leaves, roots, seed, fruits, bark and flower. Regarding all identified plants, leaves and seeds were the major plant parts used, which is in agreement with other studies⁸.

About sixteen percent of total respondent uses karela (*M. charantia*) for the treatment of diabetic and this indigenous knowledge is supported by various scientific studies. *M. charantia* have been reported to possess hypoglycaemic activity on streptozotocin induced diabetic rats and suggested that oral feeding of fruit juice may have a role in the renewal of β cell in STZ diabetic rats or alternately may permit the recovery of partially destroyed β cell⁹.

A. indica commonly known as neem is an indigenous plant widely available in Nepal. In this study about twelve percent of total respondent used *A. indica* for the treatment of diabetic which is also supported by various scientific studies. Effect of *A. indica* leaf extract on serotonin inhibition in glucose mediated insulin release in rat pancreas was studied in vitro to elucidate the possible mechanism of antihyperglycemic effect¹⁰. In another study it was shown that hydroalcoholic extracts of this plant has antihyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemi diaphragm¹¹.

Ethanollic extract of dried seed of *E. jambolana* has been reported to have antidiabetic effects on streptozotocin induced diabetes. Extract was given orally and showed dose dependent decrease in blood glucose level in diabetic rats¹². The leaf extract of *G. sylvestre* was demonstrated to possess a significant antidiabetic activity in alloxan induced and normal fasting rats in 30-day chronic studies. *G. sylvestre* crude extracts and its isolated compound, dihydroxy gymnemic triacetate, also exhibited hypoglycemic effect against streptozotocin induced diabetic rats¹³. A significant decrease in liver glycogen of diabetic rats is reversed to almost the normal level by the leaf extract of *A. marmelous* and it also decreases the blood urea and serum cholesterol. A similar effect is seen with insulin treatment and the results indicate that the active principle in *A. marmelos* leaf extract has similar hypoglycemic activity to insulin treatment¹⁴. *A. racemosus* root has previously been reported to reduce blood glucose in rats and rabbits. Study of the effects of the ethanol extract and five partition fractions of the root of *A. racemosus* were evaluated on insulin secretion together with exploration of their mechanisms of action. The ethanol extract and each of the hexane, chloroform and ethyl acetate partition fractions concentration-dependently stimulated insulin secretion in isolated perfused rat pancreas, isolated rat isletcells and clonal β cells¹⁵. Ethanollic extract *B. aristata* produced significant antihyperglycemic activity in streptozotocin induced diabetic rat which is comparable to metformin¹⁶.

In such a way the most frequently used anti-diabetic medicinal plants in Kaski District is

supported by the various scientific studies as well. There is an urgent need to explore and document the ethnomedicinal plants used by different communities of Kaski District before such knowledge vanishes. As indigenous knowledge on usages of medicinal plants is transmitted without

any systematic process and younger generation of communities are not interested in traditional healing system as it has no or very little scope for income. Thus, it becomes necessary to acquire and preserve this traditional system of medicine by documentation and identification of specimens.

Table 1: A list of plant species along with their local name, scientific name, family name, parts used and methods of uses.

S.No.	Local Name	Scientific Name	Family	Parts used	Method of use and administration
1.	Gheu Kumari	<i>Aloe vera</i>	Asphodelaceae	Leaves	Latex of leaves juice
2.	Parijat	<i>Nyctanthes Arbortritis</i>	oleaceae	Twig and flower	juice from 7 pieces of twigs or flower with water
3.	Amba	<i>Pisidium gujava L.</i>	Myrtaceae	Leaves, fruit, twig	Juice of leaves,fruit
4.	Tulsi	<i>Ocimum tenuiflorum</i>	Lamiaceae	Leaves	Eating raw leaves, decoction
5.	Kurilo	<i>Asparagus racemosus</i>	Liliaceae	Twig,stem	Eating like soup of twig
6.	Bindi	<i>Abelmoschus esculentus</i>	Malvaceae	Fruit	1 glass juice empty stomach
7.	Karela	<i>Momordica charantia</i>	Cucubitaceae	Fruit	Juice of fruit, vegetable
8.	Neem	<i>Azarieta indica</i>	Meliaceae	Juice of leaves	Leaves
9.	Tite pati	<i>Artemisia vulgaris</i>		Leaves	2,3 green leaves are chewed
10.	Asuro	<i>Justicia adhatoda</i>	Acanthaceae	Leaves	1 glass of juice from leaves
11.	Chutro	<i>Berberis aristata</i>	Berberidaceae	Roots	Root of chutro is soaked in water and that water is taken next morning, 2 times a day.
12.	Kera	<i>Musaparadisiaca</i>	Musaceae	Fruit	Raw babana is eaten
13.	Sisno	<i>Girardiana diversifolia</i>	Urticaeaceac	Growing buds	Growing buds are dried and powdered and taken by mixing with water
14.	Chinijhar	<i>Scorparia dulcis</i>	Scrophulariaceae	whole plant	Drinking juice by crushing whole plant
15.	Jamun	<i>Syzygium cumini</i>	Myrtaceae	Fruit, seed	Eaten fruits and even the seeds
16.	Methi	<i>Trigonella foenum graecumlinn</i>	Fabaceae	Seed	Seeds are soaked in water and eaten

17.	Gudmaar	<i>Gymnema sylvestre</i>	Asclepiadaceae	Leaves	leaves are eaten
18.	Amala	<i>Phyllanthus emblica</i>	Euphorbiaceae	Fruit	Chew fruit
19.	Gahu	<i>Triticum vulgare</i>	Graminaceae	Nal	Nal is boiled and water is drank
20.	Chiraito	<i>Swertia chirayita</i>	Gentianaceae	Root	root is soaked in water and that water is drink next morning
21.	Satuwa	<i>Paris polyphylla san</i>	Liliaceae	Whole plant	Crushed and taken
22.	Ukhu	<i>Saccharum officinarum</i>	Poaceae	Stem	Juice
23.	Dhobini	<i>Mussaenda macrophylla</i>	Rubiaceae	Root	Root juice
24.	Harro	<i>Terminalia chebula</i>	Combretaceae	Fruit	Dried fruits are eaten
25.	Barro	<i>Terminalia bellirica</i>	Noctuidae	Fruit	Dried fruits are eaten
26.	Lapsi	<i>Choerospondias axillaris</i>	Anacardiaceae	Fruit	Chew fruits
27.	Indrajau	<i>Hollarhenna pubecens</i>	Apocynaceae	Seed, leaf	Seeds chewed directly, decoction of leaves
28.	Bel	<i>Aegle marmelos</i>	Rutaceae	Fruit	Juice of fruit
29.	Aduwa	<i>Zingiber officinalis</i>	Zingiberaceae	Root	Juice of roots, mixed with curry and decoction
30.	Pharsi	<i>Cucurbita mixta</i>	Cucurbitaceae	Fruit	Eaten as vegetable, boiled fruit is eaten
31.	Laliguras	<i>Rhododendron arboreum</i>	Ericaceae	Flower, leaves	flower is eaten
32.	Pakhanbed	<i>Bergenia ciliate</i>	Taxaceae		
33.	Rajbriksha	<i>Cassia fistula</i>	Fabaceae	Fruit	Fruit pulp is eaten.
34.	Kyamuna	<i>Cleistocalyx operculatus</i>	Myrtaceae	Bark	
35.	Sal	<i>Shorea robusta</i>	Dipterocarpaceae	Seed	Seed are eaten
36.	Siplikan	<i>Crateva unilocularis</i>	Capparaceae	Leaves	Decoction, as curry
37.	Koiralo	<i>Bauhinia variegata</i>	Leguminosae	Flower	As curry, decoction of flower
38.	Ajammari	<i>Kalanchoe spathulata</i>	Crassulaceae	Leaves	Decoction, juice
39.	Makai	<i>Zea mays</i>	Poaceae	Fruits	Eaten boiled maize, dried maize rice
40.	Gurjo	<i>Tinospora cordifolia</i>	Menispermaceae	Whole plant	Decoction of leaves, roots are used

41.	Akbarekhursani	<i>Capsicum annum L.</i>	Solanaceae	Fruits	Eaten raw or in dried form mixed with curry
42.	Kodo	<i>Origanum vulgare</i>		Seed	Eaten dhido, roti
43.	Phapar			Seed	Eaten dhido, roti
44.	Thakailo	<i>Cirsium verutum</i>		Root	Roots are crushed and the juice is taken
45.	Kubija				
46.	Kutki	<i>Picrorrhiza kurroa</i>	Scrophulariaceae		
47.	Simali	<i>Vitex nigundo</i>	Labitaceae	Whole plant	Leaves are crushed and juice is taken
48.	Marathi	<i>Acmella calva</i>	Compositae	Whole plant	
49.	Bhuiamala	<i>Phyllanthus virgatus</i>	Euphorbiaceae	Fruit	Fruit is chewed
50.	Kantakari				
51.	Lasun			Whole plant	Leaves, roots are eaten
52.	Datiwan	<i>Achyranthes aspera</i>	Amaranthaceae	Whole plant	Decoction of the leaves are used

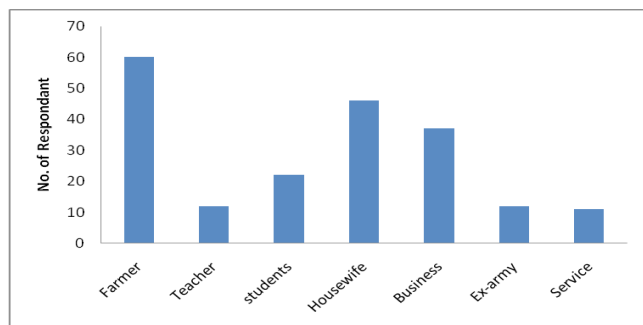


Figure 2: Personal status of respondent: Data are presented as no. of respondents with their occupations.

Table 2 : More frequently used medicinal plant by local people

Scientific Name	Local name of Plant	% of respondents
<i>Momordica charantia</i>	Karela	16.00%
<i>Azadiracta indica</i>	Neem	12.00%
<i>Asparagus racemosus</i>	Kurilo	14.00%
<i>Aegle marmellos</i>	Bel	13.00%
<i>Holorhena pubences</i>	Indrajau	12.00%
<i>Gymnema sylvestre</i>	Gudmaar	10.00%
<i>Berberis aristata</i>	Chutro	11.00%
<i>Eugenia jambolana</i>	Jamun	12.00%

CONCLUSION

Among 52 plant species of 35 families, *Asparagus racemosus*, *Momordica charantia*, *Berberis aristata*, *Azadiracta indica*, *Holorhena pubences*, *Eugenia jambolana*, *Aegle marmellos* and *Gymnema sylvestre* are the most widely used plants for anti-diabetic purposes.

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Food Consumption Practice and Nutritional Status of Adolescent Girls from Urban areas of Pokhara, Nepal

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ABSTRACT

World Health Organization defined adolescent as the population of 10-19 years of age. Inadequate food consumption patterns during adolescence are linked not only with the occurrence of obesity in youth, but also with the subsequent risk of developing diseases such as cancer, obesity and cardiovascular disease in adulthood and later in life. This study aims to assess the food consumption practice and nutritional status among adolescent girls. Cross-sectional study design was used to determine the food consumption practice and nutritional status among adolescent girls. Simple random sampling method was used in this study. Interview schedule, Bathroom Scale and Stature meter were used to collect the data from adolescent girls. Anthropometric measurements of all participants were taken and the questionnaire was filled up. Data were entered in EPIDATA 3.1 and analyzed by using SPSS version 20. In this study, majority (63.1 per cent) of participants did not consume sufficient calorie. Mean \pm SD of calorie intake was 2009.97 \pm 342.366 Kcal. In same way, 27.4 per cent, 64.6 per cent, 8.0 per cent of the participants were underweight, normal and overweight respectively. Mean \pm SD of BMI was 20.46 \pm 2.99 kg/m². Underweight was high in private schools and overweight was high in Public schools. Family monthly income and religion were associated with calorie intake and fruits consumption per week was associated with nutritional status of participants. This study concluded that around two-third of participants consumed insufficient amount calorie. It has been found that majority of the participants did not consume sufficient amount of foods from different groups like: body building and protective food as per required. Participants who consumed fruits more than 4 days per week were 2.5 times more likely to be normal (OR 2.500; 95%CI 1.194-5.233; P=0.013). So, information should be given about the balanced diet to them.

Key words: Food consumption practice, Nutritional status, Adolescent girls, Urban areas

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INTRODUCTION

Adolescent is a transition from dependent childhood to independent and responsible adulthood. World Health Organization defined adolescent as the population of 10-19 years of age. Out of estimated 27 million populations in Nepal, 23% are adolescents. It is the cross road in life when choices and decisions made become crucial for the future of an individual. Adolescent learn and adopt new knowledge and practices more easily and generally these are long lasting with impact on next generation.¹

Adolescence is an important stage of physical growth and development in the lifespan and unique changes that occur in an individual during this period are accompanied by progressive

achievement of biological maturity. For females, this is the period for preparation for motherhood.² Malnutrition passes from generation to generation, because adolescent girls that enter into pregnancy with poor nutrition are more likely to give birth to low birth weight or intrauterine growth restricted babies who are more vulnerable to metabolic disorders later in life. So adolescence period is a unique opportunity to break a range of vicious cycles of structural problems that are passed from one generation to the next such as poverty, gender discrimination, violence, poor health, and nutrition.³

Inadequate food consumption patterns during childhood and adolescence are linked not only with

the occurrence of obesity in youth, but also with the subsequent risk of developing diseases such as cancer, obesity and CVD in adulthood and later in life.⁴ This study was carried out to assess the food consumption practice and nutritional status among adolescent girls in Pokhara Sub-metropolitan.

METHODS

The study design was cross-sectional and study participants were the adolescent girls from secondary schools of grade 9th and 10th from Pokhara sub metropolitan city. The sample size was determined by assuming prevalence of undernourished adolescent girls is 68.52 per cent with an error of five per cent, 95 per cent confidence limit, and thus sample size was 540. All adolescent girls participated in this study were aged from twelve to eighteen years. The study was conducted from July to December 2016. Schools were selected using a simple random sampling technique which included all the girls from selected schools of class nine and ten. From the data available through District Education Office, there were altogether 19 public secondary schools and 103 private secondary schools in Pokhara sub-metropolitan city. In an average 20 girls were enrolled in one class of public school and 18 girls students enrolled in private school (Assumption made by taking the reference from Kaski Saichik Darpan-2069). Altogether 232 students were selected from public school and 308 students from private school. Based on proportion of private and public school, 6 public and 9 private secondary schools were selected by using lottery method but sample size completed from 4 public schools and 6 private schools.

Ethical clearance was obtained from the institutional review committee, Pokhara University. Formal permission from school Principal was taken and informed consent was taken from adolescent girls and their assent was taken from guardians before starting the interview. Face to face interview and body measurement was carried out. Enough time was provided to recall the information and to respond for question. Food consumption practice was measured by using weekly food consumption questionnaire and 24 hour dietary recall questions were used to measure daily energy intake.

The size of dishes used to measure the amount of food was of 250 ml, which was equivalent to a standard cup size. Through this reference, the amount of food was converted into a standard serving size, and the daily energy intake was calculated by Nutrition facts 0.9.5.0 version and food tables. The recommended energy requirement of adolescent girl is 2200 kcal/day. Those who met the requirement considered as sufficient calorie consumption while others were classified as insufficient calorie intake.

Other different tools were used such as UNICEF electronic weighing scale for measuring weight and stature meter for measuring height. Height and weight were measured in order to calculate BMI. The heights and weights of the participants were measured in a standing position without shoes on, whilst they looked straight ahead. The height and weight were measured in centimeters and kilograms respectively. The BMI was calculated using the following formula: weight/height^2 (kg/m²). BMI was categorized as underweight (<18.50), normal (18.50-24.99) and overweight (≥ 25.00).

Data were entered in Epidata software and analyzed by using SPSS 20 version software. Descriptive statistics (i.e., frequency, percentage, mean and standard deviation) were applied to calculate the nutritional status and food consumption practices. Associations between socio-demographic characteristics, food consumption practices and nutritional status were analyzed by using chi-square test.

RESULTS

Out of 540 participants, 57 % were from private schools and 43% were from public schools. Similarly, majority of the participants (69.8%) were of age less than 16 years followed by age group more than 16 years (30.2%). About three fourth of respondents (74.8%) were living in single family followed by one fourth joint family (25.2%). Majority of the participants (85.4%) were belonged from Hindu religion, (11.9%) were Buddhist and least from Muslim (0.7%) and Christian (2.0%).

Table 1: Socio-demographic characteristics among participants

Characteristics	Frequency	Percentage
School type		
Private	308	57.0
Public	232	43.0
Age in years		
Less than 16	377	69.8
More than 16	163	30.2
Mean=15.04, SD=0.95, Min=12, Max=18		
Family type		
Single	404	74.8
Joint	136	25.2
Religion		
Hindu	461	85.4
Buddhist	64	11.9
Muslim	4	0.7
Christian	11	2.0

Figure 1 shows that 27.4% of participants were underweight, 64.4% were normal and 8.0% were overweight.

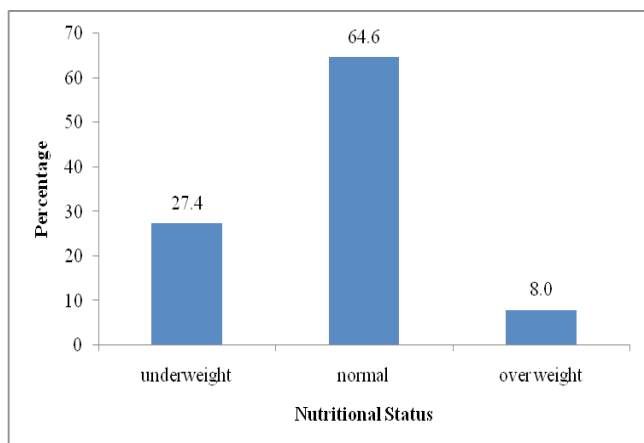


Figure 1: Nutritional status of the participants

Table 2 shows that information related to weekly food consumption. Out of 540 participants, majority (92.8%) of participants ate meat and least of them (7.2%) did not. Among students who ate meat, more than half (55.5%) ate meat equals and less than 2 days per week and (44.5%) ate more than 2 days per week. Mean± SD consumption of meat was 2.54±1.324 in last week. Similarly, more than half (59.3%) of participants did not eat fish and remaining were (40.7%) ate fish. Among them, three fourth (82.3%) ate fish once a week and remaining (17.7%) ate more than 2 days per week. Mean± SD was 1.25±0.721. Majority, i.e.

three fourth (84.4%) of participants ate egg and rest (15.5%) did not eat egg. Among them, (53.5%) of them ate egg equals and less than 2 days and 46.5 percent ate egg more than 2 days per week. Mean ± SD was 2.88±1.813. Similarly, majority (99.4%) of participants ate fruits and least (0.6%) did not eat fruits. Among (99.4%), more than half (58.5%) of participants ate equals and less than 4 days and (41.45%) ate more than 4 days per week. Mean ± SD was 4.24±1.955. Majority (96.1%) of participants ate vegetables and least (3.9%) of students did not eat vegetables. Among (96.1%), more than half (57.6%) ate equals and less than 5 days and (42.4%) ate more than 5 days per week. Mean ± SD was 4.81±1.953. Similarly, majority (89.8%) of participants ate milk and milk product and least (10.2%) of them did not. Among (89.8%), more than half (59.4%) ate more than 5 days and remaining (40.6%) ate equals and less than 5 days per week. Mean ± SD was 5.22±2.250.

Table 2: Distribution food consumption among participants

Characteristics	Frequency	Percentage
Meat consumption (n=540)		
Yes	501	92.8
No	39	7.2
Meat consumption per week (n=501)		
≤ 2 days	278	55.5
> 2 days	223	44.5
Mean=2.54, SD=1.324, Min=1, Max=7		
Fish consumption (n=540)		
Yes	220	40.7
No	320	59.3
Fish consumption per week (n=220)		
Once a week	181	82.3
More than 2	39	17.7
Mean=1.25, SD=0.721, Min=1, Max=7		
Egg consumption (n=540)		
Yes	456	84.4
No	84	15.5
Egg consumption per week (n=456)		
≤ 2 days	244	53.5
> 2 days	212	46.5
Mean=2.88, SD=1.813, Min=1, Max=7		

Fruits consumption (n=540)		
Yes	537	99.4
No	3	0.6
Fruits consumption per week (n=537)		
≤ 4	314	58.5
> 4	223	41.5
Mean=4.24, SD=1.955, Min=1, Max=7		
Vegetables consumption (n=540)		
Yes	519	96.1
No	21	3.9
Vegetables consumption per week (n=519)		
≤ 5	299	57.6
> 5	220	42.4
Mean=4.81, SD=1.953, Min=0, Max=7		
Milk and milk product consumption (n=540)		
Yes	485	89.8
No	55	10.2
Milk and milk product consumption per week (n=485)		
≤ 5	197	40.6
> 5	288	59.4
Mean=5.22, SD=2.250, Min=1, Max=7		

Table 3 shows that more than one third of the participants consumed sufficient calorie in their daily food intake whereas less than two third did not consume sufficient calorie in their daily food intake.

Table 3: Calorie consumption among participants in per day

Calorie intake	Frequency	Percentage
Not sufficient	341	63.1
Sufficient	199	36.9
Mean=2009.97 kcal, SD=342.36, Min=1205, Max=5977		

Table 4 shows that monthly income and religion were significantly associated with calorie intake. Parents whose monthly income was less than 50,000 were 1.82 times more likely to take not sufficient amount of calorie (OR 1.828; 95%CI 1.135-2.944; P=0.012). Likewise, participants who were Hindu were 1.90 times more likely to take not sufficient calorie (OR 1.903; 95%CI 1.104-3.279; P=0.019). In this study, socio-demographic factors like; Age, Family type, Father Education and Mother Education were not found to be associated with calorie intake.

Table 4: Association of socio demographic factors with calorie intake

Factors	Not sufficient	Sufficient	χ^2	p value	OR	95%CI
Age in years			2.458	0.117	0.733	(0.497-1.082)
Less than 16	230(61.0%)	147(39.0%)				
More than 16	111(68.1%)	52(31.9%)				
Family type			1.006	0.316	1.226	(0.823-1.826)
Single	260(64.4%)	144(35.6%)				
Joint	81(59.6%)	55(40.4%)				
Father education			3.378	0.066	1.503	(0.972-2.326)
Primary	85(70.2%)	36(29.8%)				
Secondary and above	256(61.1%)	163(38.9%)				
Mother education			0.913	0.339	1.19	(0.833-1.699)
Primary	148(65.5%)	78(34.5%)				
Secondary and above	193(61.5%)	121(38.5%)				
Monthly income of family			6.239	0.012*	1.828	(1.135-2.944)
Less than 50000	202(67.1%)	99(32.9%)				
More than 50000	48(52.7%)	43(47.3%)				
Religion			5.476	0.019*	1.903	(1.104-3.279)
Hindu	218(66.3%)	111(33.7%)				
Non-hindu	32(50.8%)	31(49.2%)				

Table 5 shows out of 540 participants more than one fourth were underweight, two third were normal and least of them were overweight. The mean \pm SD of BMI was 20.46 \pm 2.99 kg/m².

Table 5: Nutritional status of participants

Nutritional status	Frequency	Percentage
Underweight	148	27.4
Normal	349	64.6
Overweight	43	8.0
BMI: (Mean=20.4606 kg/m ² , SD=2.99451)		

Fruits consumption per week was found to be significantly associated with nutritional status. Participants who consumed fruits more than 4 days per week were 2.5 times more likely to be normal (OR 2.500; 95%CI 1.194-5.233; P=0.013). However Meat consumption per week, Egg consumption per week, Fish consumption per week, Vegetable consumption per week and Milk and milk product consumption per week has no association with nutritional status (Table 6).

Table 6: Association of weekly food consumption with nutritional status

Characteristics	Malnutrition	Normal	χ^2	P value	OR	95%CI
Fruits per week			6.236	0.013*	2.5	(1.194-5.233)
\leq 4 days	33(14.3%)	198(85.7%)				
> 4 days	43(11.0%)	348(89.0%)				
Meat per week			1.894	0.169	1.609	(0.814-3.182)
\leq 2 days	27(13.4%)	175(86.6%)				
>2 days	14(8.8%)	146(91.2%)				
Egg per week			0.051	0.822	0.918	(0.438-1.927)
\leq 2 days	15(9.3%)	147(90.7%)				
>2 days	16(10.0%)	144(90.0%)				
Fish per week			0.108	0.742#	1.289	(0.273-6.085)
Once a week	13(9.7%)	121(90.3%)				
more than 2	2(7.7 %)	24(92.3%)				
Veg. per week			0.287	0.592	1.199	(0.617-2.328)
\leq 5 days	25(11.7%)	189(88.3%)				
>5 days	16(9.9%)	145(90.1%)				
Milk and milk product per week			2.621	0.105	1.781	(0.879-3.608)
\leq 5 days	20(13.0%)	134(87.0%)				
>5 days	15(7.7%)	179(92.3%)				

* Statistically significant χ^2 based p-value from bivariate analysis, # p-value from likelihood ratio

DISCUSSION

The recommended energy requirement of adolescent girl is 2200 kcal/day. The assessment of food intake by adolescent girls of class 9 and 10 attending public and private schools of Pokhara city showed that, only 36.9 per cent of adolescent girls consumed sufficient amount of calorie whereas majority 63.1 per cent did not consume sufficient calorie as per RDA. The frequency of food intake for less than 4 times in a day was 81.1 per cent and more than 4 times in a day was 18.9 per cent. In this study, based on weekly food intake, a substantial proportion of girls did not consume fish (59.3%) and egg (15.5%). In comparison with them larger portions consumed meat (92.8%), fruits (99.4%), vegetables (96.1%) and milk and milk products (89.8%). A study conducted on Dhaka city also showed that based on usual pattern of food intake, a substantial proportion of girls did not consume egg (26%), milk (35%), and dark green leafy vegetable (20%). In comparison larger proportion consumed meat (50%), fish (65%) a least four times a week. Similarly, for intake of energy and protein, only 9 per cent and 17 per cent of girls respectively met RDA.⁵ Which might be due to difference in study area and participants wealth index. Similarly, another study conducted in Europe also showed that adolescents eat half of the recommended amount of fruit and vegetables and less than two-thirds of the recommended amount of milk (and milk products), but consume much more meat (and meat products), fats and sweets than recommended.⁴ Likewise, a study conducted in Barcelona, Spain showed that the prevalence of adolescents following food recommendations is low.⁶

This study revealed that, 27.4 per cent of participants were underweight, 64.4 per cent were normal and 8.0 per cent were overweight. The mean BMI was 20.46kg/m². A study conducted among adolescent school girls in Adwa Town, North Ethiopia also showed that the overall prevalence of thinness among adolescent school girls was 21.4 per cent.³ Similarly, other studies showed that 36 per cent of girls were underweight, 47 per cent were of normal weight and 17 per cent were overweight for their height.⁷ Likewise, the study conducted in Tunisian adolescents showed

prevalence of underweight, overweight and obesity was 1.3 per cent, 20.7 per cent and 4.4 per cent respectively among girls.⁸ A study conducted in rural area of Wardha district also showed that 53.8 per cent of the adolescents were thin, 44 per cent were normal and 2.2 per cent were overweight. The mean body mass index (BMI) for girls was 15.54.⁹ These variation in results may be due to the variability of sample size.

This study indicated that monthly income and religion were found to be associated with the dietary intake of adolescent girls of class 9 and 10 ($p < 0.05$). Both the factors monthly income and religion were found to be significantly differs with the nutritional status of adolescent girls ($p < 0.05$). No association was observed in calorie intake and nutritional status. A study conducted in Germany to determine the association between parental socio-economic position and health among adolescents also showed association of parental socio-economic position and their educational level with consumption of less energy, dense food more fruits and vegetable and more favorable overall dietary behavior.¹⁰ This study showed the association between fruits consumption per week with the nutritional status of adolescent girls. Similarly, no association was observed between socio-demographic factors and nutritional status among adolescent girls. A study conducted in West Bengal also showed no significant association between socio-demographic factors and nutritional status among adolescent girls.¹¹ Likewise, study conducted among adolescent in Ethiopia showed that age of the adolescents, educational status are associated with underweight; and place of residence, household size, household income, educational status, employment status are associated with stunted. The findings reflect socio-demographic characteristics are associated with underweight and stunting.¹²

CONCLUSION

This study concluded that around two-third of participants were consumed insufficient amount calorie. It has been found that majority of the participants did not consume sufficient amount of foods from different groups like: body building and protective food as they required. Participants

who consumed fruits more than 4 days per week were 2.5 times more likely to be normal (OR 2.500; 95%CI 1.194-5.233; P=0.013). More than one fourth of the participants were underweight, more than half of the participants were normal and least (8%) of them were overweight. Mean±SD of BMI was 20.46±2.99 kg/m². There was not significantly association between calorie intake and nutritional status of the participants. However, fruits consumption per week (p=0.013) is significantly associated with the nutritional status of participants. So, information should be given about the balanced diet to them.

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Nutritional Status and its Associated Factors among Adolescents

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ABSTRACT

Maintaining energy balance among adolescents is of paramount challenge. Many adolescent boys and girls in developing countries enter either with negative or positive energy balances and both results into diseases and ill health. The study aimed to find the nutritional status and its associated factors in school going adolescents of Lekhnath Municipality of Kaski district of Nepal. Cross-sectional analytical study was conducted in public secondary schools of Lekhnath Municipality among 356 adolescents through cluster random sampling. OMRON body fat analyzer, bathroom scale, stadiometer were used for body fat percentage and BMI calculation. Pretested self-administrable questionnaire was used to assess nutritional factors of adolescents. Frequency tabulation, chi square test, binomial logistic regression and correlation were done for statistical analyses. Prevalence of underweight, overweight, stunting and thinness were found to be 50.6 percent, 11 percent, 2.5 percent and 16.9 percent respectively. According to body fat percentage- 49.4 percent, 32.2 percent and 18.4 percent were lean, normal and obese. Seventy percent of adolescents performed high physical activity followed by 31.7 and 14 percent moderate to low physical activity. Only 3.1 percent of adolescents consumed recommended daily intake of fruits and vegetables. Age, gender, religion, ethnicity, family type and availability of kitchen garden were associated with body mass index. Early adolescent, male, Hindu, students from nuclear families were found more underweight than their counterparts. Underweight is more prevalent than overweight among adolescents. Health promoting programs including kitchen garden and fruits and vegetables intake are recommended.

Key words: Nutrition, adolescent, factor, overweight, underweight, developing, physical

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INTRODUCTION

Nutritional status is the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity.¹ Health and nutritional status are crucial interlinked aspects of human development. Adolescent is a period of physical, psychological and social maturation which is one fifth (22%) of the total population of Nepal.¹ Adolescents' malnutrition, an alarming public health problem worldwide²⁻⁴ is imposing a great threat to the future generation via vicious cycle. The study aimed to find the nutritional status and its associated factors in school going adolescents of Lekhnath Municipality.

METHODS

School-based cross-sectional analytical study

was conducted among 356 adolescents of secondary grades of public schools of Lekhnath Municipality during August 2016 to December 2016 AD. Cluster random sampling technique was used to select participants from ten to 19 year adolescents. Physically challenged and mentally impaired were excluded.

Data collection tools and techniques

Clinically validated human Body Fat Analyzer HBF-306 C (OMRON Healthcare Europe B.V. Scorpio 33, 2132 LR Hoofddorp, Netherlands) was used to measure body fat percentage and to assess body type. Body weight was assessed using bathroom scale and height was measured with stadiometer. Measured height and weight were then entered into body fat analyzer along with the age and gender and body fat percentage

was calculated. Pre-tested self-administered structured questionnaires were distributed after clear instructions by the researcher in order to assess the associated factors. For anthropometry, weight was self assessed by the researcher by requesting respondents to take off their shoes and to step on the sensor board of the digital weighing scale with their hands freely suspended. Height was measured using stadiometer, researcher requested respondents to take off their shoes and stand erect on the plank of stadiometer with their back being parallel to the meter. Thus prior to data collection, by asking respondents to take off any metallic objects such as rings, bracelets etcetera they were wearing, respondents were requested to catch the metallic handle of the hand held fat analyzer and were requested to stretch their arms forward making it perpendicular to the chest. The reading obtained from the machine was then entered into the respondent's coded questionnaire by the researcher himself. For the assessment of the consumption of fruits and vegetables by the respondents researcher in class demonstrated the flash cards and approximated serving sized sample plastic fruits and vegetables and bowls for helping the respondents assess their daily consumed serving amount of fruit and vegetables easily and precisely.

Ethics

Ethical clearance was obtained from Institutional Review Board, Pokhara University. First of all, verbal consent was taken from the school administration of the selected schools. Then, one day prior to the data collection, a written consent letter was sent to the parents of the selected grade. After having parental consent, written consent was taken from the participants after clearly explaining them the objectives of the study.

Anthropometric measurements and measurement of body fat percentage was done of students who consent to participate and then questionnaires were distributed. Privacy and confidentiality of collected information was ensured at all level. After filling the questionnaire; students put the filled questionnaire in an envelope and sealed it. Envelop was collected by the researcher on the same day to maintain the confidentiality. Furthermore confidentiality of obtained data was maintained. The research had the following advantages to the study subjects: (a) it helped them to know about their nutritional status. (b) Adolescents identified as malnourished were referred to nearest health facility. (c) Follow-up of only selected referred subjects was done due to time constraints. And finally (d) following anthropometric assessment a 30 minutes class was conducted explaining the importance of consumption of fruits and vegetables and physical exercise after the completion of data collection.

Statistics

Data were entered in Epi-data and then imported to SPSS version 20 to analyze. We calculated frequency and percentage to describe and chi-square test, odds ratio and correlation to make inferences. Alpha value was set at 5% to make the inferences.

RESULTS

According to body mass index, half of the respondents (50.6 %) were found to be underweight with 38.3 percentage being normal and 11.0 percent of them being overweight. The prevalence of stunting was found to be 2.5 percent and thinness to be 16.9 percent. According to body fat percentage, adolescents were categorized into four body types.

Table 1: Nutritional status and physical activity among adolescents

Variables (n= 360)	Frequency (n)	Percentage	Male	Female
Body Mass Index (kg/m ²)				
Underweight (<18.5)	182	50.6	107(58.8)	75(41.2)
Normal (18.5 – 24.9)	138	38.3	44(31.9)	94(68.1)
Overweight (≥ 25.0)	40	11.0	19(47.5)	21(52.5)
Median(Q ₁ ~Q ₃)[min, max]	18(17~21)[13, 36]			
Stunting				
Stunted (<-2 SD)	9	2.5	7(77.8)	2(22.2)
Not- stunted(>-2 SD)	351	97.5	163(46.4)	188(536)

Thinness				
Thin (<-2 SD)	61	16.9	42(68.9)	19(31.1)
Not thin (>-2 SD)	299	83.1	128(42.8)	171(57.2)
Body fat percent				
Lean	178	49.4	103(57.9)	75(42.1)
Normal	116	32.2	35(30.20)	81(68.9)
Obese	66	18.4	32 (48.5)	34(51.5)
Median(Q ₁ ~Q ₃) [min, max]	20 (15~26) [7, 38]			
Physical activity (MET min per week)				
High (≥ 3000)	241	66.9	122(50.6)	119(49.4)
Moderate (600-2999)	114	31.7	48(42.1)	66(57.9)
Low (<599)	5	1.4	0(0)	5(100)
Median(Q ₁ ~Q ₃)[min, max]	4322 (2446.5~7949.5) [181, 63668]			

Half (49.4% lean; 50.6% underweight) of the participants were malnourished, whereas more than half were doing sufficient physical activity (median MET=4322) (Table 1).

Table 2: Association between body mass index and socio demographic characteristics

Socio Demographic Variables (n=360)	Body Mass Index n (%)			χ^2 value	p-value
	Underweight	Normal	Overweight		
Age					<0.001*
Early adolescents	95(56.4)	47(28.0)	26 (15.5)	16.4	
Middle and late adolescents	87(45.3)	91(47.4)	14(7.3)		
Gender					
Male	107(62.9)	44(25.9)	19(11.2)	22.8	<0.001*
Female	75(39.5)	94(49.5)	21(11.1)		
Religion					
Hindu	163(53.8)	114(36.9)	32(10.4)	4.3	0.112*
Non- Hindu	19(37.3)	24(47.1)	8(15.7)		
Ethnicity					
Indigenous/ethnic	95(43.6)	101(46.3)	22(10.1)	15.0	0.001*
Brahmin/chettri	87(61.3)	37(26.1)	18(12.7)		
Family type					
Single	118(57.6)	76(37.1)	11(5.4)	18.9	<0.001*
Joint	64(41.3)	62(40.0)	29(18.7)		
No of family members					
≥ 5	120(51.3)	90(38.5)	24(10.3)	0.5	0.774
<5	62(49.2)	48(38.1)	16(12.7)		

*Statistically significant at $p < 0.05$

Age, gender, religion, ethnicity and family type were found to be associated with BMI, whereas number of members in the family was not associated (Table 2). Similarly, all the significantly associated variables

of BMI were also found to be associated ($p < 0.05$) with under-nutrition (Table 3). However, only age and family type were found to be associated with over-nutrition ($p < 0.05$) (Table 4).

Table 3: Association between socio demographic factors and underweight

Characteristics n= 360	Underweight n (%)	No underweight n (%)	χ^2 value	p-value	Unadjusted OR (95% CI)
Age					
Early Adolescents	95(52.2)	73(41.0)	4.52	0.033*	1.57
Middle and Late Adolescents	87(47.8)	105(59.0)			(1.03-2.38)
Gender					
Male	107(58.8)	63(35.4)	19.76	< 0.001*	2.60
Female	75(41.2)	115(64.6)			(1.70-3.98)
Religion					
Hindu	163(89.6)	146(82.0)	4.20	0.040*	1.88
Non- Hindu	19(10.4)	32(18.0)			(1.02-3.46)
Ethnicity					
Indigenous/Ethnic	95(52.2)	123(69.1)	10.76	0.001*	0.44
Brahmin/Chettri	87(47.8)	55(30.9)			(0.31-0.75)
Family Type					
Single	118(64.8)	87(48.9)	1.14	0.002*	1.92
Joint	64(35.2)	91(51.1)			(1.26-2.94)

*Significant at $p < 0.05$

Table 4: Association between socio demographic characters and Overweight

Characteristics n= 360	Overweight n (%)	No overweight n (%)	χ^2 value	p-value	Unadjusted OR (95% CI)
Age					
Early Adolescents	26(65.0)	142(44.4)	6.07	0.014*	2.32
Middle and Late Adolescents	14(35.0)	178(55.6)			(1.17-4.62)
Gender					
Male	19(47.5)	151(47.2)	0.001	0.970	1.01
Female	21(52.5)	169(52.8)			(0.52-1.95)
Religion					
Hindu	32(80.0)	277(86.6)	1.25	0.262	0.62
Non- Hindu	8(20.0)	43(13.4)			(0.26-1.43)
Ethnicity					
Indigenous/Ethnic	22(55.0)	196(61.2)	0.58	0.446	0.77
Brahmin/Chettri	18(45.0)	124(38.8)			(0.39-1.49)

Family Type					
Single	11(27.5)	194(60.6)	0.49	<0.001*	0.24 (0.11-0.51)
Joint	29(72.5)	126(39.4)			

* Significant at p<0.05

Table 5: Association between dietary behavior and BMI

Dietary Behavior (n= 360)	Body Mass Index n (%)			χ ² value	p-value
	Underweight	Normal	Overweight		
Intake of fruits & vegetable					
< 5 servings daily	175(50.1)	135(38.7)	39 (11.2)	0.8	0.674
≥5 servings daily	7(63.6)	3(27.3)	1(9.1)		
Light drinks intake per month					
< 3 times	155(50.2)	123(39.8)	31(10.0)	3.5	0.167
≥ 3 times	27(52.9)	15(29.4)	9 (17.6)		
Packet food intake per week					
<3 times	128(50.6)	95(37.5)	30(11.9)	0.5	0.754
≥ 3 times	54(50.4)	43(40.2)	10(9.3)		
Restaurant food intake per week					
<3 times	166(51.4)	123(38.1)	34(10.15)	1.4	0.483
≥ 3 times	16(43.2)	15(40.5)	6(16.2)		
Physical Activity (MET min per week)					
High (≥ 3000)	119(49.4)	94(39.0)	28(11.60)	0.4	0.797
Moderate to low (< 2999)	63(52.9)	44(37.0)	12(10.1)		
Kitchen garden at home					
Yes	169(56.3)	106(35.3)	25(8.3)	28.6	<0.001*
No	13(21.7)	32(53.3)	15(25.0)		
Canteen at school					
Yes	166(57.0)	101(34.7)	24(8.2)	29.0	<0.001*
No	16(23.2)	37(53.6)	16(23.2)		

* Significant at p<0.05

Most of the dietary behaviours were insignificant with BMI. However, availability of kitchen garden at home and canteen at school (or nearby) were significantly associated with BMI (Table 5).

Table 6: Correlation of physical activity with BMI and body fat percentage

Variable	R	p- value
Body fat	-0.151**	0.004
Body mass index	-0.113*	0.032

* Correlation is significant at the 0.01 level (2-tailed)

**Correlation is significant at the 0.05 level (2-tailed)

Both body fat and BMI were significantly and inversely correlated with physical activity although the value (r) in both condition was negligible (Table 6).

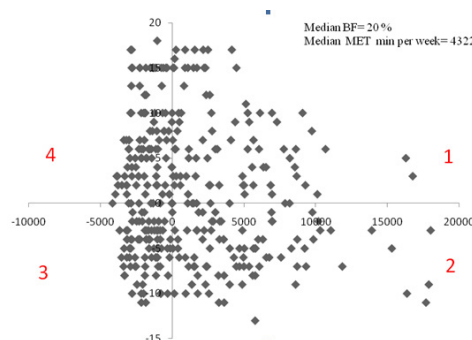


Fig. 1: Correlation between body fat percent and physical activity

Five outliers were removed (n=355) in the scatter plot analysis.

Quadrant "4" consists of 102 adolescents performing less than median physical activity and those adolescents who had more body fat than the median body fat. These 102 adolescents should be provided participation in school PE and community recreation programs.

Quadrant "3" consists of 78 adolescents performing less than median physical activity and those adolescents who had less body fat than the median body fat .

Quadrant "2" consists of 84 adolescents performing more than median activity and those adolescents who had less than the median body fat. These adolescents relatively need less attention.

Quadrant "1" consists of 91 adolescents performing more than median physical activity and those adolescents who had more than the median body fat (Figure).

DISCUSSION

The present study revealed 11 percent prevalence of overweight which is akin to the studies conducted in Nepal² itself where prevalence was 12.2 percent and Saudi Arabia³. The study's prevalence of overweight is comparatively lower than in the other studies conducted in urban African American adolescents⁴, China⁵, Spain⁶, Egypt⁷ and Russia⁸ but higher than those studies conducted in Nigeria⁹ and Ghana⁷ where prevalence is 1.8 and 8.7 percent respectively. This difference might be due to larger economy, wealthier people and adaption of sedentary lifestyles. Females were more overweight than males which is a similar case in study conducted in public school going Brazilian¹⁰, Portuguese¹¹ and Palestrina adolescents¹². Gender was also found significant with overweight in other studies conducted in China^{5,13-15} but it contrasted studies conducted in India¹⁶, Palestine¹⁷, Brazil¹⁸, Mozambique¹⁹, Kuwait²⁰ reported no difference in gender with BMI. Early adolescents were found to be twice more likely to be overweight, this may be because during early adolescence they are less concerned about their body image. Moreover, the study was conducted in peri-urban setting where access to junk and packaged food is prominent around residence and schools. Taken together, the results of some study and of ours suggest that

factors such as food intake and especially the consumption of energy-dense food and sugar-sweetened drinks may play an important role in the development of overweight and obesity^{21, 22}.

The result of this study on prevalence of underweight (50.6 %) is higher than the study conducted in Qatar (8.6%)²³, Iran²⁴, Spain (21%)⁶, China (6.4%)⁵, Egypt (12.6%)⁷ and Djibouti (31.9%)⁷. Male were twice more likely to be underweight than female in this study which is similar to findings from South Africa²⁵ but is contradictory with findings from study conducted among Spanish²⁶, Bulgarian¹⁵ and German¹⁴ adolescents. This may be because male were found to be more vigorously physically active than females in this study and may be because of better living conditions, improved nutrition, better medical facilities and improvement in the environment and socioeconomic factors of other developed countries. Other reported the prevalence of underweight in Nepal was 36 percent which is lower than the present study²⁷.

In this study the prevalence of stunting was found to be 2.5 percent. This is lower than that of Ethiopia^{28, 29} where the prevalence is 12.2 percent and Afghanistan³⁰. Stunting is higher among boys than that of girls which is similar case in Ethiopia²⁹ (37.7 % boys vs. 21.2% girls) England³¹ and Saudi Arabia³². Stunting among girls in Nepal³³ was found 32 percent which is higher than the present study. However, the prevalence of stunting in different studies was 47 percent, 51.9 percent, 48 percent 37.8 percent^{34, 35-37}. This reflects the prevalence of short stature was higher in their studies as compared to the present study, (median height was 159 centimeters in this study) but a comparable finding to them was that the short stature was increasing with the increasing age of the adolescents especially during the late adolescence period. Overall, the similarities in all the studies indicate that the similar factors might co-exist in all the population but to different degrees. Of the various possible factors, dietary inadequacy is basically believed to have the greatest impact on growth. Since stunting is regarded as a form of chronic malnutrition, most investigations into the cause of poor growth in developing countries have concentrated on nutritional availability and

dietary consumption which might be a similar case in context of ours as well.

The study revealed the prevalence of thinness (BMI for age) to be 16.9 percent. This prevalence is almost similar to that of southern Ethiopia²⁸, Cameroon³⁸ but lower than that of northern Ethiopia²⁹ where prevalence is 26.1 percent. In this study boys were more thin than girls (42 vs. 19) which is similar to the study conducted among Portuguese¹¹ adolescents but is opposite to that of China³⁹, European Country where girls are more thin⁴⁰. This difference may be due to the increased body dissatisfaction among girls in affluent countries which have been well documented⁴¹.

In order to assess the dietary pattern and frequency of eating, students were asked about the frequency of intake of light drinks in the past 30 days and packet food and restaurant food in last seven days. Dietary behaviors responses were dichotomized into multiple options. The consumption of light drink a day was found to be very high (60.6%) among the students which shows that young generation are getting inclined towards the daily use of light drinks. The number of students eating packet food in the past 7 days was found to be high. Only 1.9 percent didn't eat packet food in the past 7 days while the number of students who once ate packet food in the past 7 days was high i.e. 49.2 percent followed by 19.2 percent who ate 2 days in the past 7 days. These findings are consistent with the study conducted among Mexican adolescents⁴². Likewise, only about 14.4 percent students didn't eat in the restaurants in the past 7 days. There have been evidence of increased packet and fast food consumption due to the proximity of fast food restaurants⁴³, and since this study was conducted in a Semi-urban setting this could be also the reason coupled with the influence of advertisement and western culture.

In this study only 3.1 percent of students were found to be consuming the recommended intake of fruits and vegetables of five servings a day, this is higher than the prevalence observed in Costa Rica⁴⁴ where prevalence is only 2 percent, Brazil⁴⁵, Africa⁴⁶, Czech Republic⁴⁷ and a decreasing prevalence is also found among Korean⁴⁸ and Southeast Asian adolescents⁴⁹. Studies have documented the

prevalence of eating recommended five servings of fruits and vegetables as high as 40.4 percent in Djibouti to 10 percent in Pakistan⁵⁰ and 26 percent in Brazil⁵¹ which are all higher than the findings from this study. Availability of fruits and vegetables in school canteen and consumption of light drinks and fast foods have been found to be positively associated with fruits and vegetables intake^{45, 52} and since 67.2 percent of students under this study reported that they had no access to fruits and vegetables in their school canteen with three by fourth (84%) adolescents consuming light drinks up to 3 times past week; this might be the reason for the low intake.

In order to assess the level of physical activity among adolescents' data were collected with IPAQ and recorded as a continuous measure that yield total energy expenditure in metabolic equivalent (MET-min) values per week. Volume of activity was computed by weighting each type of activity by its energy requirements defined in Metabolic Equivalent Time (MET) to yield a score in MET-minutes. METs are multiples of the resting metabolic rates and a MET-minute was computed by multiplying the MET score of an activity by the minutes performed according to IPAQ protocol. The study found plurality of students (66.9 %) performing high level of physical activity with boys performing more (50.6%) than girls (49.4%) this is consistent with the findings from Kuwait²⁰ (66% active boys vs. 44% active girls), Saudi Arabia^{53, 54}, Malaysia⁵⁵, Tunisia⁵⁶, Korea⁵⁷ and Palestine¹⁷ but the study's prevalence is lower as compared to Taiwan⁵⁸.

Significant association was observed between age, gender, religion, ethnicity and family type with body mass index. Evidence of such association is found from affluent countries like United States⁵⁹ to low and middle income country like South-Western Nigeria⁶⁰. But there was no association between number of family members and body mass index.

Present study revealed a significant association between the availability of kitchen garden, availability of canteen at school and body mass index. Similar associations have been observed in study conducted on other part of Nepal⁶¹.

Surprisingly, behavioral variables like intake of fruits and vegetables, light drinks, packet foods and restaurant food were found not associated with BMI. Contradictory to this, intake of fruits and vegetables were found to be associated in Chinese⁶², European⁶³ and African adolescents⁶⁴. And intake of beverage and fast food was found associated in Tunisia⁶⁵ and Brazil⁶⁶.

Bio electrical impedance method was used for the assessment of body fat percentage of the adolescents. Findings from hand held bio electrical impedance method using OMRON HBF 306 model body fat analyzer highly correlates to one from Dual-Energy X-ray Absorptiometry (DEXA)⁶⁷⁻⁷⁰, the same model used in this study. On basis of this nearly half (49.4%) were lean followed by 32.2 percent and 18.4 percent normal and obese adolescents respectively. Median body fat percent was 20 with IQR (15-26) which is lower than that of study conducted in India⁶⁷ where median was 31.3 percent. Similar prevalence of obesity (15%) was observed in of India⁷¹ and Iran but higher in the northern India⁷² where BF percent was above 25 percent among 44 percent of study population. In Iran⁷³, 14.6 percent were lean which is much lower than finding from current study. The study found out a weak negative linear relationship between physical activity and body fat percent with a significant and inverse cross-sectional relation between physical activity and body fat percent.

CONCLUSION

Median physical activity level was high (4322 MET) whereas half of the students were undernourished. Students with above median fat (more than 20%) and less than median physical activity (4322 MET-minute per week) are recommended to physical activity and recreations.

CONFLICT OF INTEREST

We declare that we have no competing interests.

SOURCES OF SUPPORT

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Removal of lead (II) ions from aqueous solution by Hydroxyapatite biosorbent extracted from Ostrich bone

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ABSTRACT

Hydroxyapatite (HAp) is a broadly studied bioceramic for biomedical implant and bone tissue regeneration. Despite this, it is a good adsorbent of heavy metal ions. Its chemical formula is $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$. It was extracted by the calcination process from Ostrich bone. The obtained HAp was characterized by X-ray diffraction (XRD) and Fourier transforms infrared (FTIR) spectroscopy and was used for removal of lead (II) ion from aqueous solutions. A series of experiments were conducted in order to determine the effects of pH, contact time and sorbent dosage in a optimize condition for maximum adsorption. The results showed that the removal efficiency of Pb (II) ions reached 99.04% with an initial concentration of 50 mgL^{-1} , pH range; 3 to 7 and 1 hour contact time. The adsorption rate of Pb (II) ions onto the HAp was found incredibly fast and equilibrium was reached within 5 minute. Within this time 72.32% of lead (II) ions were removed. The equilibrium removal process of Pb (II) ions at pH range 4.5-5.5 were well described by the Langmuir isotherm model, with a maximum adsorption capacity of 430.7 mg/g.

Key words: Ostrich bone, hydroxyapatite, calcinations, adsorption, Pb (II) ion, pH.

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INTRODUCTION

Heavy metals are the elements having a specific gravity at least five times than water as well as toxic even intake in a low amount¹. These metal ions found in water especially from transition metal series are of foremost concern due to their toxicity to several life forms. Its effect is cumulative and can cause serious health problems including damage of visceral organs and the nervous system. On prolonged exposure, it can cause cancer in these organs which may go ahead to death².

The toxicity of these metal ions is enhanced due to the accumulation in living tissues through food chain³. Among the different heavy metal ions, the lead (II) ion is important on the viewpoint of environmental toxicology⁴. Lead metal and its ionic compounds are widely applied in different industries such as paint and pigments, ceramics and pottery, storage batteries, alloys, and solder as well as in petrol refining⁵. Owing to these uses, this ion often found in industrial effluent and there is a high risk of intermixing with drinking

water resources. Therefore, the removal of this ion from industrial effluent as well as drinking water resources is necessary for public health concern.

Although the different removal techniques have been proposed by different researchers, chemical precipitation, membrane filtration, ion exchange, and biosorption are the most commonly applied techniques⁶. Among these, the biosorption is more reliable and convenient technique because of its low processing cost, high efficiency of adsorption, minimization of chemical and biological sludge, high possibility of regeneration of adsorbent and metal recovery⁷⁻⁹. Because of these beneficial aspects, in this study, the biosorbent technique was applied for the removal from an aqueous medium. HAp biosorbent can be prepared either from chemical precursors or from biogenic resources. In compare to chemical precursors bio-based resources are economical and HAp extracted from this resources are highly preferable for removal of heavy metal ions due to its low water solubility and greater stability under redox conditions. The

elemental components of HAp are hydrogen, oxygen, phosphorous and calcium along with carbon which is expected to have no toxicity¹⁰. Moreover, HAp isolated from biogenic resources have received considerable attention in the field of dental and bone tissue engineering because of its chemical, structural and morphological resemblance with human hard tissue minerals¹¹⁻¹³.

MATERIALS AND METHOD

Bone sample collection

Minimum 2 kg of cortical bone was collected from Ostrich farmhouse located at Gangolya-1, Rupendehi district, the western region of Nepal. The samples were cleaned to remove visible adhered substances and then cut into small pieces using a hacksaw.

Chemicals and Reagents

All necessary analytical grade chemicals and reagents such as $\text{Pb}(\text{NO}_3)_2$, KNO_3 , NaOH , HCl , HNO_3 , NaCl and Acetone were purchased from Merck Chemicals (India) and used without further purification.

Preparation of Biosorbent

Bone pieces were boiled for about 4 hours in a closed container for deproteination after that wash several times by tap water and dried overnight at 120°C in a hot air oven. The dried bone pieces were crushed in an iron mortar and powdered in a high-speed disc pulverized machine. Furthermore, alkaline hydrothermal hydrolysis process was applied for removal of residual collagens and fatty tissues. Finally, the bone powder was calcinated at 650°C in a muffle furnace using a heating rate of $5^\circ\text{C}/\text{min}$ for 6 hours holding time and slow furnace cooling to obtain grayish-white bone ash and recalcinated at 950°C for another 6 hours in the same condition to obtained final product. The flow sheet diagram of preparation process is shown in figure 1.

Preparation of Lead (II) ion Stock Solution

Analytical grade lead nitrate, $\text{Pb}(\text{NO}_3)_2$ was used for the preparation of stock solution (1000 mg/L). The experimental solutions were then prepared by diluting the stock solution. The concentration of these solutions was determined by using Flame Atomic Absorption Spectrometer (FAAS).

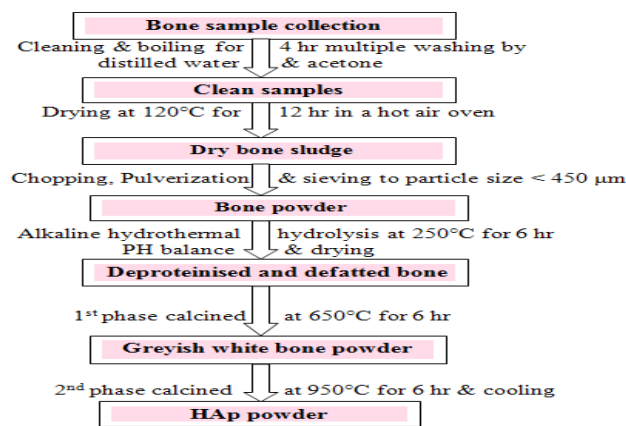


Figure 1. Flow sheet diagram of extraction of HAp biosorbent from Ostrich bone.

Characterization of Biosorbent

To study the crystallinity of the prepared biosorbent, powder X-ray diffraction (Bruker-D2) patterns were recorded using $\text{Cu K}\alpha$ radiation target with a second monochromator at 40 kV and 40 mA. Fourier transform infrared (FTIR) spectroscopic (Shimadzu-8300 IRTF) analysis was performed to identify the presence of major functional groups, and the point of zero charge (pH_{pZC}) was measured by a batch equilibrium technique, with 0.1M of KNO_3 as an inert electrolyte¹⁴.

Determination of Acido-basic Properties

The acido-basic properties of biosorbent were determined by using the point of zero charge (pH_{pzc}) method¹⁴. In this method, 500 mL of 0.01M NaCl solution was degassed by using N_2 in order to remove dissolved CO_2 . 10 mL of 0.01M NaCl solution was taken in 10 different conical flasks and 1-10 pH of each solution in flasks were maintained by adding either HCl or by NaOH standard solution. 10 mg of HAp was added in the solution of each flask and kept in a mechanical shaker for 3 hours with 150 rpm. The final pH of each solution was measured after 24 hours.

Batch Sorption Experiments

Biosorption equilibrium assays were carried out by using the batch adsorption process. Each of the batch adsorption studies was carried out by adding HAp powder within experimental lead (II) ions solution at lab temperature ($25^\circ\text{C}\pm 0.1$). A series of experiments were conducted in order to determine the effects of pH, contact time, and sorbent dosage on the adsorption. Each experiment was conduct-

ed in a mechanical shaker at 150 rpm. After the required time to reach equilibrium, all the samples were filtrate and the final concentration of lead(II) ions in solution were determined by using the flame atomic absorption spectrophotometer (Shimadzu AA 6500, air/acetylene gas mixture).

Calculations

All experiments were carried out in triplicate and the mean of the quantitative results was used for further calculations. The amount of lead (II) ions adsorbed onto the biosorbent surface qt (mg/g) was calculated by using a mass balance relationship as;

$$qt = \frac{(C_0 - C_t)V}{m} \dots\dots(I)$$

Where qt (mg/g) is the adsorption capacity of biosorbent; C_0 and C_t are the initial and equilibrium concentration (mg/L) of lead (II) ions in solution; V (L) is the total volume of solution; and m (g) is the weight of the adsorbent taken. Similarly, the percentage of lead (II) ions removal by adsorbent was also determined by using the expression;

$$\text{Removal \%} = \frac{(C_0 - C_t) \times 100}{C_0} \dots\dots(II)$$

RESULTS AND DISCUSSION

X-ray Diffraction (XRD) Phases Analysis

The XRD patterns and exhibiting peaks corresponding to extracted HAp were found to be similar with standard HAp data of Joint Committee on Powder Diffraction Standards (JCPDS) card No 01-074-0565, which indicate that there is no secondary phase and the synthesized HAp was pure¹⁵ as shown in figure 2.

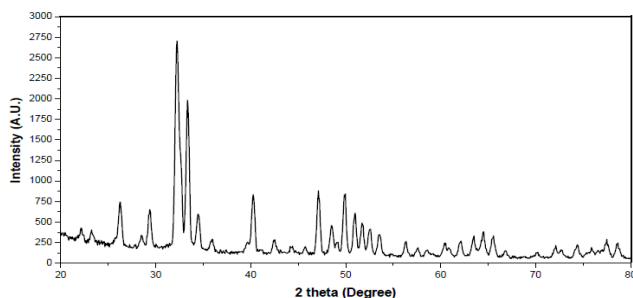


Figure 2. X-ray diffraction (XRD) patterns of HAp biosorbent extracted from Ostrich bone.

FTIR Analysis

The Fourier transform infrared (FTIR) analysis was performed to identify the presence of different functional groups in biosorbent. The FTIR spectrum of the HAP after two phase calcination is shown in figure 3. The spectrum noticeably shows the presence of phosphate bands at 1062.78, 871.83, 607.57 and 570.95 cm^{-1} and hydroxyl bands at 3570.24 and 3479.59 cm^{-1} which indicate the presence of major functional groups¹⁶⁻¹⁹ in addition with carbonate bands at 2015.61 and 2362.80 cm^{-1} .

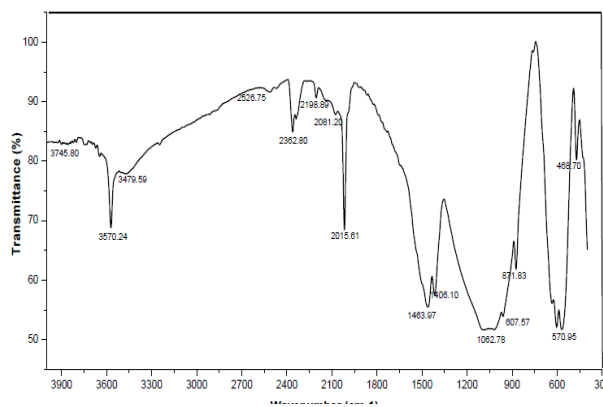


Figure 3. FTIR spectra of HAp biosorbent extracted from Ostrich bone.

Point of Zero Charge (pH_{pzc})

Point of zero charge method was used to determine the acido-basic properties on HAp surface²⁰. It is defined as the pH at which the total surface charges of biosorbent become zero. The plot of pH_{pzc} is shown in Figure 4. The graph is plotted against the difference data of initial pH (i.e. pH₀) and final pH (i.e. pH_f) values (i.e. $\Delta\text{pH} = \text{pH}_0 - \text{pH}_f$) versus initial data of pH. The point of intersection of the resulting curve at abscissa gave the pH_{pzc} value of HAp. In this study, this value was found exactly 3.0. The value signify that at pH less than 3.0, the positive charge surface of the HAp was predominated, while at pH greater than 3.0, the negative charge surface was predominated. This study shows that pH is the significant domain for determining the charge on HAp surface in aqueous medium which greatly influence the adsorption process²¹.

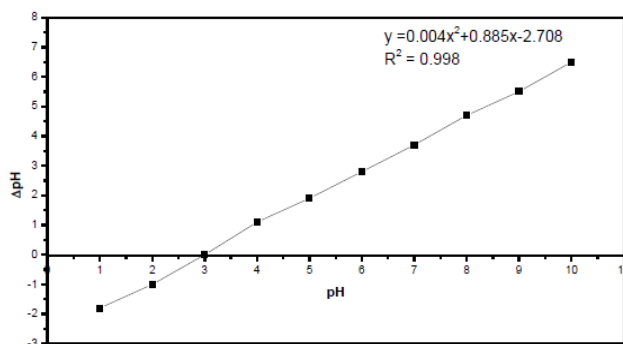


Figure 4. Point of zero charge (pHpzc) of HAp biosorbent extracted from Ostrich bone.

Effect of pH

The effect of solution pH on adsorption of lead (II) ions was investigated by varying the solution pH from 1 to 8. The solution pH was adjusted by using 0.1M HNO₃ and 0.1M NaOH and recorded in a digital pH meter. The initial lead (II) ion concentration was taken 50 mg/L. Figure 5 shows the efficiency of removal was increased significantly as pH increased from 1 to 6 and remains constant beyond 6.

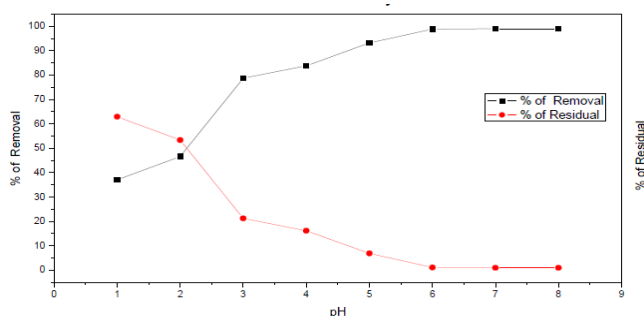


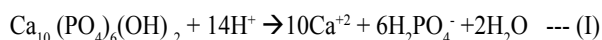
Figure 5. Effect of pH on percentage of removal of pb(II) ion on HAp surface.

A result shows that adsorption process is strongly pH dependent. Previous studies shows 49% of HAp is dissolved at pH 1 and 16 % at pH 2²². In one fold, there is no great effect of dissolution of HAp at pH 3. Therefore, the adsorption of lead (II) ions was suppressed at pH less than 3 due to the damage of crystalline phase of HAp as well as it may also be caused due to the formation of soluble hydroxyl complexes in acidic environments²³⁻²⁵. But in another fold, increasing the pH of solution, the competition between the positive charge bearing lead (II) ions becomes decreases due to the domination of negatively charged surface active

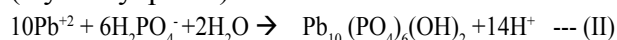
sites of HAp which improve the adsorption of the positively charged lead (II) ions by electrostatic force of attraction^{26,27}. As a result, on conducting the experiments at optimum pH range from 4-6 make sure the presence of the divalent form of lead ions as well as conserve the chemical stability of HAp. Moreover, in one hand, the pHpzc value of HAp was found 3.0 which signify that, HAp surface has +ve charged at solution pH less than 3.0 due to which lead(II) ions were repelled with HAp surface resulting in the reduction of adsorption. In another hand, at pH elevated than pHpzc, the surface of HAp starts to deprotonated (i.e. it bears negative charge) due to which adsorption kinetics increases^{28, 29}. Thus, at optimum pH (4-6) the removal efficiency was reached up to 98.86 %. This result is in good agreement with the results of previous works of Mousa *et al.*

Removal mechanism

Among the different prescribed mechanisms such as; ion exchange, surface complexation, dissolution, precipitation of metal phosphate and substitution of calcium ion of HAp by metal ion during re-crystallization, presented by Meski *et al.* dissolution and precipitation is the most preferable for removal of lead (II) ion from aqueous solution. According, to these mechanism, at optimum pH, HAp ionize to provide free hydrogen phosphate (H₂PO₄⁻) ion and this ion combines with Pb(II) ions in aqueous medium to form insoluble lead complex which is precipitate as a hydroxyromorphite and decrease the concentration of lead (II) ion in solution. The reactions of removal mechanism are shown below;



(Hydroxyapatite)



(Hydroxyromorphite)

Effect of contact time

Result shows that the adsorption of lead (II) ions onto the HAp surface was remarkably fast and equilibrium was reached within 5 minutes in which the removal percentage reached up to 72.32% as shown in the figure 6. The adsorption curve was single, smooth and continuous, leading to saturation and indicated the possible monolayer coverage on the surface of the adsorbent by the lead (II) ions.

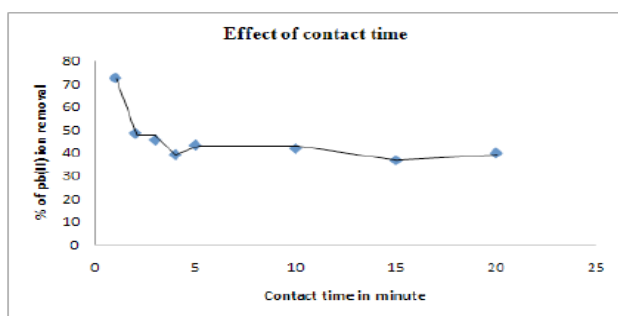


Figure 6. Effect of contact time on percentage of removal of pb(II) ion on HAp surface.

Further increase in contact time has no radical effect on the removal percent. Therefore, 5 minute shaking time was sufficient to reach equilibrium for maximum adsorption. The decrease in the rate of removal with contact time may be due to aggregation of lead (II) ions around HAp surfaces. This aggregation may hamper the migration of lead (II) ions from bulk to HAp surface as the adsorption

sites become saturated, as well as resistance to the diffusion of lead (II) ions in the adsorbents increases³⁰. Moreover, this aggregation of lead (II) ions with increase in contact time makes it almost impossible to diffuse lead (II) ions deeper into the HAp structure at the highest energy sites. These results are in good agreement with the results of earlier studies of Meski *et al.*

Effect of adsorbent dosage

Principally adsorption process is the surface phenomenon, on that basis effectiveness affect by surface area and available active sites of adsorbent which depends on its amount taken³¹. In this study, effect of adsorbent was studied at various experimental dosages: 10mg/L, 20mg/L, 25mg/L, 30mg/L, 40mg/L, 50mg/L and 100mg/L at constant initial concentration of Pb(II) ion (i.e. 50mg/L), constant pH range of 4.5-5.5 and fixed contact time of 90 minutes as shown in table 1.

Table 1. Amount of lead (II) ions removal by HAp biosorbent.

SN	Initial conc. of Pb (II) ion (C_0)	Final conc. of Pb(II) ion (C_f)	Adsorbent dosage	pH range	qt = ($C_0 - C_f$)V/m
1	50mg/L	6.93 mg/L	10 mg/L	4.5-5.5	430.7 mg/g
2	50mg/L	13.31mg/L	20 mg/L	4.5-5.5	183.45 mg/g
3	50mg/L	5.79 mg/L	25 mg/L	4.5-5.5	176.84 mg/g
4	50mg/L	2.71 mg/L	30 mg/L	4.5-5.5	157.63 mg/g
5	50mg/L	1.21mg/L	40 mg/L	4.5 -5.5	121.23 mg/g
6	50mg/L	0.91 mg/L	50 mg/L	4.5-5.5	98.18 mg/g
7	50mg/L	0.52 mg/L	100 mg/L	4.5-5.5	49.48 mg/g

In adsorbent dose 10 g/L, there is a significant removal of lead (II) ions. A previous study shows that adsorption processes are mainly a surface phenomenon; therefore, adsorption efficiency can be considerably affected by surface area and availability of active sites which is ultimately related to the mass of adsorbent³². As the adsorbent dosage increases there are inverse trends of removal due to the aggregation and overlapping of active sites of adsorbent which show the way to the decrease in the effective surface area required for maximum adsorption^{33, 34}.

CONCLUSION

This study shows that the biosorbent extracted from Ostrich bone has a good result for adsorp-

tion of lead (II) ions from aqueous solution. The adsorption was greatly pH dependent, with a high uptake (430.7mg/g) of lead (II) ion at pH range 4 - 6. Results also show the lead (II) ion adsorption is very sensitive to the initial concentration of lead ion in solution. The mechanism of dissolution of HAp and precipitation of hydrophyromorphite was dominant by a low concentration (50mg/L) and in optimum (4-6) pH range. The adsorption of lead (II) ions is very fast and the equilibrium was attended within 5 minutes. 72.32% lead (II) ions were removed within this time. There is an inverse relationship between contact time and percentage of removal. A similar trend was also found in between adsorbent dosage and amount of removal of lead (II) ions from aqueous solution.

SCOPE OF THE STUDY

The application of HAp as a biosorbent has shown the better potential for removing lead ion (II) from aqueous solution. Results obtained in this study are significant to previous research works which proved that it is a well-known biosorbent and provide good background for further investigation of removal of other heavy metal ions like Cd (II), Cr (III), Hg (II), Sb (III) and Ni (II) from aqueous solution. Furthermore, this biosorbent has the potential on removing different color dyes such as; Methylene blue, Congo red, Reactive yellow, Lemon yellow, Cheery red etc from industrial effluents of dye industries. Further characterization of this biosorbent is highly recommended before and after adsorption study.

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Birth Spacing in Deurali VDC of Kaski district of Nepal

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ABSTRACT

Birth spacing is the interval that the couples maintain between two successive children. World Health Organization (WHO) and other international organizations recommend that individuals and couples should wait for at least 3-5 years between births in order to reduce the risk of adverse maternal and child health outcomes. Having children too close together has long been associated with increased risk of various adverse health outcomes, including mortality, for infants, children and mothers. But in developing countries women are giving birth to children in short gap which is causing infant, child and maternal mortality. The main objective of the study is to assess the determinants of birth spacing. A cross sectional study was carried out in Deurali VDC of Kaski. The study population comprised of married women of reproductive age having at least one child. The data was collected by using semi structured interview schedules and collected data were entered in Epi-data and analyzed using SPSS. The total sample was 262, among them most of the 130 (49.6%) respondents were >30 years old while 13 (5%) of respondents were <20 years old. The minimum age was 15 and maximum age was 45 years. The mean \pm SD of age of the respondents was 31.65 \pm 7.144 years. Majority 231 (88.2%) of respondents were Hindu and 123 (48%) were of upper caste. Majority of 151 (57.6%) respondents lived in joint family and 158 (60.3%) of respondents were house wives. Educational status of respondents shows that 79 (30.2%) had primary education. Only 69 (26.3%) of respondents were found using temporary family planning methods 91 (34.7%) and unwanted pregnancy. Depo-Provera and implant were found common among family planning users. The main reason for inadequate birth spacing was hope for male child 184 (70.2%), however, 212 (20.9%) respondents also said that adequate birth spacing is determined to maintain health of the mother and child.

Key words: Birth spacing, determinants, family planning, married women of reproductive age

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INTRODUCTION

Birth spacing is a one of the important factors that affects maternal, infant and child health. It is the length of time between two successive live births. The median birth interval in Nepal is 36.2 months in 2011, which was increased from 31.8 months in 2001.¹

Family planning has received attention in demography and public health research because of its implication on fertility as well as benefits for both mother and child by keeping longer birth interval. The World Health Organization (WHO) and other international organizations recommended that the individual and couple should wait for at least 2-3 years between two pregnancies to reduce infant and child mortality and improve maternal health.²

The birth spacing has been considerably affected the mortality, birth size and weight, and nutritional status of children, and the risk of pregnancy complication for mothers. Giving the birth shorter than 36 months differences have been shown to increase the risk of mortality, and pregnancy morbidity. Similarly, spacing of more than five years also increased risk of pregnancy complications to mothers and neonates. The actual space between 36 and 59 months shows lower risk. Both short and long spacing practices are associated with increased risk of adverse perinatal and neonatal outcomes.³

The birth spacing is affected by many factors, such as social and cultural norms, reproductive histories

and behavior of individual women, utilization of the reproductive child health services. Likewise, the death of a child in infancy or early childhood has been found to be associated with short birth intervals. Residence, education and occupation of the mothers were also associated with birth spacing. In some settings, maternal education is associated with short spacing. A study from Korea reported that better educated women had shorter second birth intervals than those of less educated. However, in 38 of 51 countries Demographic Health Survey (DHS) data shows that women with no education were more likely to have shorter birth interval than educated women.⁴

Family planning and contraceptive use are the principle ways for a woman to delay the next birth. The demand for contraception for spacing births includes current use of contraception by married women who want another birth in two or more years and women with an unmet need for spacing. The overall surveys revealed that, about 25.5 percent of currently married women have a demand for contraception for birth spacing. The demand for contraception for spacing has increased at an annual average rate of 0.22 percent points (+2.2 per decade), while almost half of the demand is unsatisfied 46.3 percent, and the unsatisfied percentage has declined at rate of 12.1 percent points per decade.⁵

The knowledge of contraception is universal in Nepal, one in two currently married women is using a method of contraception, among which most of women use modern method (43 percent). However the unmet need for family planning services among currently married women is 27 percent, with 10 percent having unmet need for spacing and 17 percent having an unmet need for limiting.⁶ The study main aims is to assess the determinants of birth spacing.

METHODS

A cross sectional descriptive study was conducted in Deurali VDC of Kaski District of Nepal. The proportion to population size and stratified random sampling technique was used to select respondents. The total samples size was 262. Women who were married of reproductive age having one child with their consent were participated in the study.

Data was collected after getting approval from concerned authority. Anonymity and confidentiality of the respondents were maintained throughout the study. The data was primarily collected after obtaining informed consent. Validity of the instruments was maintained by incorporating expert's opinion, avoiding direct leading and duplicating question and through extensive literature review. Pretesting was performed in 10% of the total sample size in another similar setting which was excluded from the study and minor modifications on tool were made as well.

Reliability of the instrument was 0.82 that indicates tool reliability. The collected data were coded and entered in EpiData 3.1 software. The entered data was exported to SPSS for analysis.

RESULTS

Table 1: Socio-Demographic Information of Respondents (n=262)

Variables	Frequency (f)	Percentage (%)
Age		
<20 years	13	5.0
20-30 years	119	45.4
>30 years	130	49.6
Religion		
Hindu	231	88.2
Buddhist	22	8.4
Muslim	1	0.4
Christian	8	3.2
Ethnicity		
Dalit	49	18.7
Disadvantaged Janajati	1	0.4
Disadvantaged non Dalit Terai caste	3	1.2
Religious minorities	1	0.4
Relatively advantaged Janjati	83	31.7
Upper caste group	125	47.6
Types of family		
Nuclear	109	41.6
Joint	151	57.6
Extended	2	0.8

Majority 119 (45.4%) of the respondents were between 20 to 30 years. The minimum age was 15 years and maximum age was 45 years. The mean age was 31.65± 7.14 years. Majority 231 (88.2%) of respondents were hindu and 123 (48%) of respondents were upper caste group. Most of 151 (57.6%) of respondents belonged to joint family.

Table 2: Socio- Economic Status of Respondents (n=262)

Variables	Frequency (f)	Percentage (%)
Educational status of respondents		
Illiterate	24	9.2
Informal schooling	44	16.8
Primary	79	30.2
Secondary	73	27.8
Higher secondary	27	10.3
Bachelor and above	15	5.7
Occupation of respondents		
House wife	158	60.3
Farmer	47	17.9
Business	35	13.4
Services	19	7.3
Daily wedges	3	1.1
Family income (NRs/Month)		
<50000	15	5.7
50000-20000	138	52.7
20000-40000	68	26
>40000	41	15.6
Primary source of information on birth spacing practice n = 256		
Mass media	148	57.8
Health worker	99	38.7
Social services	7	2.7
Family/friends	2	0.8

The 79 (30.2%) of respondents had primary education and 158 (60.3%) of respondents were house wife. With regards to family monthly income (Rs/month) 138 (52.7%) of respondents had income ranged between Rs 5000 to 20,000. Almost all 256 (97.7%) of respondents had information regarding birth spacing, among those 148 (57.8%) had got information from mass media.

Table 3: Respondents based on knowledge on birth spacing (n=262)

Variables	Frequency (f)	Percentage (%)
Meaning of birth spacing		
Correct answer	164	62.6
Incorrect answer	98	37.4
Appropriate spacing time		
1-2 years	8	3.3
2-3 years	78	29.7
3-5 years	99	37.7
>5 years	77	29.3

The most of the respondents 164 (62.6%) gave correct meaning of birth spacing practice and 99 (37.7%) of respondents were know about appropriate spacing time.

Table 4: Respondents practice of family planning (n=262)

Variables	Responses	
	Frequency (f)	Percentage (%)
Current use of family planning device		
Yes	69	26.3
No	193	73.7
Use of temporary family planning device (n=69)		
Condom	2	2.9
Pill	12	17.4
IUCD	3	4.3
Depo-provera	27	39.2
Implants	25	36.2
Discomfort due to contraceptives (n=69)		
Yes	33	47.8
No	36	52.2
Discomfort of using contraceptive device* (n=33)		
Anorexia	1	3
Weakness	3	9.1
Headache	1	3
Irregular bleeding	25	75.8
Weight gain	3	9.1
Reason for not using contraceptive* (n=193)		
Fear of harm	26	13.5
Feeling unnecessary	40	20.7
Husband aboard	45	23.3
Permanent FP	82	42.5
Place to obtain family planning device*		
Hospital	261	99.6
Pharmacy	260	99.2
Health post	262	100
Family planning clinic	260	99.2
PHC	260	99.2

Multiple responses*

The majority 193 (73.7%) of the respondents were not using family planning devices. Among the users 69 (26.3%) the highest 27 (39.1%) of respondents used depo- provera while least 2 (2.9%) used condom. Among the user, 36 (52.2%) of respondents does not have any discomfort while using family planning devices, those who have discomforts had irregular bleeding. The main reason for not using contraceptive because 82 (42.5%) had permanent family planning. Most of the respondents obtain spacing methods from health post.

Table 5: Determinants of birth spacing related factors (n=262)

Variables	Responses	
	Frequency (f)	Percentage (%)
Factors influencing inadequate spacing practice*		
Unwanted pregnancy	91	34.7
Unmet need of FP	21	8
Family/husband pressure	38	14.5
Hope for male child	184	70.2
Motivating factors for good spacing*		
Helps to maintain health of mother and child	212	80.9
Helps to reduce population growth	31	11.8
Sufficient time for rearing	134	51.1
Enough knowledge on FP	33	12.6
Decision regarding use of contraceptives		
Respondents only	35	13.4
Respondent's husband only	199	76.0
Both couple	28	10.6
Duration of exclusive breast feeding		
2 months	12	4.6
3 months	22	8.4
5 months	139	53.0
6 months	89	34.0
Distance to reach health facility by foot		
30 minutes	207	79.0
60 minutes	43	16.4
90 minutes	10	3.8
120 minutes	2	0.8
Outcome of first pregnancy		
Live	234	89.3
Still birth	7	2.7
Abortion	21	8.0
Under 5 mortalities		
Yes	35	13.4
No	227	86.6

Multiple responses*

The major factors that influences for inadequate birth spacing was hope for male child 184 (70.2%). The main reason for keeping adequate birth spacing mentioned by 212 (80.9%) respondents was that it helps to maintain health of mother and child. Decision regarding use of contraceptive devices was mainly made by respondent husband i.e.199 (76%).

Regarding breastfeeding, 139 (53.1%) of respondents breastfeed for 5 months, health facility was nearby walking distance within 30 minutes

to reach among majority 207 (79%) respondents. Majority 234 (89.3%) of respondents had live birth and 35 (13.4%) of respondents had under 5 mortalities.

DISCUSSION

Birth spacing is a real concern in both developed and developing countries. In this study, 13 (%) of respondents were 20 years below, 119 (45.4%) of respondents were between 20-30 years and 130(49.6%) of respondents were above 30 years. the minimum age was 15 years and maximum age was 45 years. The finding contradicts with the study conducted in Saudi Arabia study shows that minimum age was 18 years and maximum of 49 years.⁷ Majority 231(88.2%) of respondents were from Hindu religion; 123(48%) of respondents were of upper caste group; 151(57.6%) respondents belonged to joint family; 158 (60.3%) of respondents were house wife, the findings which were consistent with the study from Pokhara valley.⁸

Seventy nine (30.2%) of respondents were found with primary education the findings consistent with the study of Saudi women 34.7% had primary school education.⁷ Majority (97.7%) of respondents had information on birth spacing which was obtained from mass media in 57.8%. The finding of the study was consistent with another study which was conducted in Reproductive and Child Health (RCH) and Maternity Units of Achimota Hospital of the Greater Accra Region of Ghana. The study result revealed that a greater proportion of women (98%) had heard about birth spacing.⁹ The present study showed that family planning use was 26.3% which was less than study conducted on Surendranagar India and higher than by NDHS 2011 and Terengganu Malaysia.^{1,10}

In the present study, 164 (62.9%) of respondents gave correct answer related to meaning of birth spacing practice and 99 (37.7%) of respondents knew about appropriate spacing time while similar findings was found in the study. Sixty percent of the study participants were knowledgeable about optimum birth spacing.¹¹ The results showed that almost all, 806 (99.4%) of the respondents, reported the presence of health advantages of practicing optimal birth interval and 807 (99.5%)

reported the presence of negative consequences of practicing short birth interval.¹¹

In present study, most of the respondents do not agree family planning harms the health; the study of rural southern region of Jordan and Ethiopia also found that about 95% and 99.4% of the women respectively agreed that using family planning had positive advantages for health.^{12,13}

Among the family planning users in the present study, majority 25 (75.8%) had irregular bleeding the findings was more consistent with the study from Kenya.¹⁴

With regard to decision on contraceptive use, majority 199 (76%) decision was made by respondent's husband and in 28 (10.6%) decision was taken by both couple which is similar with the study on Gender roles and practice of decision making on reproductive behavior of the couple of Syangja district, Nepal. The study from Syangja result revealed that decision making on the use of contraceptives and plan for pregnancy was mostly mutual (62.1% and 74.8% respectively).¹⁵

CONCLUSION

The determinants of birth spacing primarily depend on the different factors related to the family planning. There is still unmet need of family planning for which Government of Nepal is making effort to strengthen family planning services all over the country with special focus on disadvantaged group. Women are aware of meaning of birth spacing though they did not know about appropriate spacing, thus, required attention on family planning education. The most common family planning methods used by respondents were Depo-Provera followed by Implants. Irregular bleeding was the common side effect among user of contraceptive. The main reason for inadequate spacing was hope for male child which is cultural and social influences in Nepalese Community.

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Prevalence of Internet Addiction among Higher Secondary Level Students in Kathmandu District

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ABSTRACT

Internet addiction is defined as an impulse control disorder, which is very similar to pathological gambling. It is typically characterized by psychomotor agitation, anxiety, craving depression, hostility, substance experience, preoccupation, loss of control, impairment of function, reduced decision-making ability, and constant online surfing despite negative effects on social and psychological welfare. An institutional based cross-sectional study with a sample comprising of 422 college students (15 – 19 age group) across Kathmandu District was conducted from November 9th – 23rd, 2014. Students were assessed with a structured questionnaire and Internet Addiction Test (IAT) scale, which was anonymously self-administered. The collected data was analyzed with the help of SPSS version 20 and interpreted.

This survey depicts internet penetration rate was 97.3%. The possible addicts/internet addict students were found to spent average of 34 hours per week, compared to the 11 hours of average users. Male students were more possible addicts/internet addicts than female students. This survey found statistically significant difference between average users and possible addicts/internet addicts based on their Family Characteristics which consisted of variables such as economic status ($p = 0.001$), within family relationship ($p = 0.009$), ownership of computer/laptop at home ($p < 0.001$) and loneliness level at home ($p < 0.001$). Based on the interpersonal relationship at college, there was no significant difference between average users and possible/ internet addicts except for the relationship with classmates ($p = 0.024$). Overall, the prevalence of internet addiction among higher secondary level students according to this survey was found to be 2.57. As a result of IAT scale, the prevalence of internet addiction among higher secondary level students of Kathmandu District according to this survey was found to be 2.57.

Key words: Adolescent, Internet addiction, Internet Addiction Test, Internet Penetration Rate, Nepal, Prevalence

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INTRODUCTION

Internet addiction (IA) is defined as an impulse control disorder, which does not involve use of an intoxicating drug, and is very similar to pathological gambling.¹ The term ‘Internet addiction’ was first used by Dr. Ivan Goldberg (1995) for pathological compulsive internet use.² The other terms to describe negative effects of Internet use include ‘compulsive Internet use’, ‘pathological Internet use’, ‘Internet dependency’ and even ‘Internetomania’.¹

Researchers have related Internet addiction to addictive syndromes similar to impulse-control

disorders on the Axis I Scale in the Diagnostic and Statistical Manual of Mental Disorders (DSM), and employed various forms of DSM-IV based criteria to define Internet addiction.³ Indeed, IA is currently being considered by the American Psychiatric Association for inclusion in the DSM-V as a psychiatric diagnosis.⁴

Dr. Kimberly Young, who developed the Internet Addiction Test (IAT) and now popularly being used worldwide, suggested the following diagnostic criteria: compulsive tendency to use the Internet, tolerance, withdrawal, unintended excessive use of

the Internet, continuous desire to use the Internet, decreased interest in other activities and ignorance of the negative effects of excessive Internet use.⁵ Dr. Young linked internet addiction in DSM-IV and adapted the DSM-IV criteria to relate to internet use in IAT. According to her, there are various types of internet addiction such as cyber-sexual addiction, cyber-relationship addiction, net compulsions, information overload, and computer addiction.²

Numerous studies have been conducted across the world, especially among adolescents with respect to Internet Addiction. In a study on the prevalence of internet addiction and its association with psychopathology in Indian adolescents using Young's original criteria, it identified 24.8% as possible addicts, and 0.7% as addicts.² However, there are limited studies done in Nepal, perhaps this growing issue is overshadowed by other health problems in the country. Thus, the aim of this study was to explore the prevalence of internet addiction among higher secondary level students in Kathmandu district.

METHODS

An institution based cross-sectional study design was carried out among secondary level students aged 15 – 19 years of six colleges (10% out of 56 colleges in Kathmandu district which consists of large number of higher secondary schools with high student density).⁶ Purposive sampling was applied to select the Ten plus two colleges and convenient selection of classes was done. Census method was applied to select the students. The surplus data were considered for entry and analysis.

The total sample size of the study, calculated using Fishers' formula $n = Z^2 pq/d^2$ and assuming 50% prevalence of internet addiction among adolescents, allowable error ± 0.05 at 95 percent confidence level, 10% as non-response rate, was 422.

The study tool was primarily adapted from the Internet Addiction Test (IAT) questionnaire developed by Dr. Kimberly Young. The Internet Addiction Test (IAT) is a 20-item 5-point Likert scale that measures the severity of self-reported compulsive use of the internet.⁵ Total internet addiction scores are calculated, with possible

scores for the sum of 20 items ranging from 20 to 100. According to Young's criteria, total IAT scores 20 – 49 represent average internet users with complete control of their internet use, 50 – 79 represent over-users with occasional or frequent problems caused by their internet use, and 80 – 100 represent internet addicts with significant problems caused by their internet use. Further the IAT scores was categorized into average internet users (20 – 49) and possible addicts/internet addicts (50 – 100).

Approval from Nepal Health Research Council was obtained. The written informed consent was taken from the HSEB of Kathmandu, six colleges and respondents. The participants were well informed about the purpose and objectives of the study and voluntary participation.

Anonymous self-administered questionnaire was used as technique for data collection in this study. The data collection was carried out within 15 days, from November 12th – 23rd, 2014.

The data was entered in EpiData version 3.1. Data were categorized into similar attributes. All the data were imported to SPSS version 22 and analysis was done accordingly. Univariate analysis; was done to analyze frequency of different demographic, socioeconomic characteristics. Bivariate analysis was done to cross tabulate different independent variables with dependent variables in order to determine the association between them.

RESULTS

Out of 440 respondents, 215 (48.9%) were male and 225 (51.1%) of them were female. Upper caste (Brahmins and Chhetris) were predominant by ethnicity, i.e. 57%. This survey revealed that more than half of the respondents (64.5%) had heard of Internet Addiction whereas, the rest respondents had not heard of Internet Addiction. Among those who had heard of IA, 83.8% were not aware of the effects of IA and even those who claimed to know the effects of IA, i.e. 16.2%, of them did not know the major effects like depression, social-phobia, sleep disorders, etc.

The internet penetration rate among the students was 97.3% whereas, only 2.7% had never used

internet. The prevalence of internet addiction was found to be 2.57 (Table 1).

Table 1: Internet Addiction Level

IAT Score Category	Frequency	Percent
Average users	281	65.65
Over users	136	31.78
Internet addicts	11	2.57
Total	428	100.0
Average users (281, 65.65%)		
Possible Addicts /Internet Addicts (136 + 11 = 147, 34.35%)		

Out of the responses given by 428 internet users, majority of the students had internet access at home i.e. 82.1%, followed by 12.9% at cyber and

5.1% at college. Among the internet users, 60.7% had computer/laptop with internet access in their room. Majority of the students used mobile phones for internet use i.e. 52.7%.

The observed difference of Internet Addiction Level between male and female students was statistically significant ($p = 0.001$). Likewise by ethnicity, economic status, within family relationship, ownership of computer/laptop at home, loneliness level at home, and relationship with classmates, the observed difference of Internet Addiction Level was found to be statistically significant as shown in Table 2.

Table 2: Association between Internet Addiction Level and Independent Variables

Characteristics		Total n = 428		Average Users		Possible Addicts/ Internet Addicts		p-value
		n	%	N	%	N	%	
Sex	Male	213	49.76	124	58.22	89	41.78	0.001
	Female	215	50.23	157	73.02	58	26.98	
Ethnicity	Brahmin	130	30.37	99	76.15	31	23.85	0.038
	Chhettri	111	25.93	71	63.96	40	36.04	
	Tharu	14	3.27	10	71.43	4	28.57	
	Magar	18	4.21	13	72.22	5	27.78	
	Newar	85	19.86	51	60.00	34	40.00	
	Dalit	9	2.10	5	55.56	4	44.44	
	Others	61	14.25	32	52.46	29	47.54	
Economic Status	Rather wealthy	33	7.71	16	48.48	17	51.52	0.001
	Medium wealthy	159	37.15	94	59.12	65	40.88	
	Medium	217	50.70	161	74.19	56	25.81	
	Medium low	17	3.97	10	58.82	7	41.18	
	Rather poor	2	0.47	0	0.00	2	100.00	
Within Family relationship	Very good	234	54.67	165	70.51	69	29.49	0.009
	Good	149	34.81	95	63.76	54	36.24	
	Satisfactory	40	9.35	20	50.00	20	50.00	
	Poor	5	1.17	1	20.00	4	80.00	
Computer/ laptop in room	Yes	260	60.75	147	56.54	113	43.46	<0.001
	No	168	39.25	134	79.76	34	20.24	
Loneliness level at home	Much	40	9.35	20	50.00	20	50.00	<0.001
	Little	234	54.67	134	57.26	100	42.74	
	None	154	35.98	127	82.47	27	17.53	
Relationship with teachers	Very good	87	20.33	54	62.07	33	37.93	0.896
	Good	226	52.80	152	67.26	74	32.74	
	Satisfactory	106	24.77	69	65.09	37	34.91	
	Poor	7	1.64	5	71.43	2	28.57	
	Very poor	2	0.47	1	50.00	1	50.00	

Relationship with classmates	Very good	201	46.96	133	66.17	68	33.83	0.024
	Good	177	41.36	124	70.06	53	29.94	
	Satisfactory	46	10.75	23	50.00	23	50.00	
	Poor	4	0.93	1	25.00	3	75.00	
No. of close friends	1 to 2	108	25.23	70	64.81	38	35.19	0.82
	3 to 6	163	38.08	110	67.48	53	32.52	
	7 or more	157	36.68	101	64.33	56	35.67	
Loneliness level at college	Much	30	7.01	16	53.33	14	46.67	0.145
	Little	200	46.73	127	63.50	73	36.50	
	None	198	46.26	138	69.70	60	30.30	

The study revealed that students spent about 3 hours per day and spent \$6.35 per month in average on internet (Table 3). 35.9% respondents used internet for social networking, followed by entertainment (32.4%), education (21.4%), online gaming (7.3%), online buying/selling (1.6%) and

online job (1.4%). The possible addicts/internet addicts spent nearly three times the number of hours per week online and about two times the money spent per month on internet than the average users.

Table 3: Online Daily and Money Spent on Internet based on Internet Addiction Level

	Total (Mean)	Average Users (Mean)	Possible Addicts/Internet Addicts (Mean)
Online daily (in hrs)	3	1.58	4.82
Money spent monthly (in \$)	6.35	4.63	9.63

Among internet users, 55.6% feared that life without the Internet would be boring, empty, and joyless, 42.1% found themselves saying “just a few more minutes” when online, whereas, 33.4% tried to cut down the amount of time spend online and failed, and 21.0% lost sleep due to late-night log-ins (Table 4).

Table 4: Score Percentage of Internet Addiction Test by Internet Users

Situations (Note: 0 = Doesn't Apply; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4-5 = Often/ Always)	0 (%)	1 (%)	2 (%)	3 (%)	4-5 (%)
1. Stay online longer than intended	6.3	24.8	21.0	18.7	29.2
2. Neglect household chores to spend more time on-line	20.1	34.8	18.7	10.5	15.9
3. Excitement of the Internet to intimacy with the partner?	39.5	17.5	12.1	9.8	21.0
4. Form new relationships with fellow on-line users	24.3	31.3	16.4	10.0	18.0
5. Others in life complain about the amount of time spend on-line	14.7	27.8	15.4	12.4	29.7
6. Grades or college works suffer because of the amount of time spend on-line	29.0	31.3	16.1	11.0	12.6
7. Check e-mail before something else that need to do	19.2	19.4	18.5	14.0	29.0
8. Job performance or productivity suffer because of the Internet	51.2	21.0	12.4	8.2	7.2
9. Become defensive or secretive when anyone asks you what you do on-line	27.8	25.5	18.2	12.6	15.9
10. Block out disturbing thoughts about life with soothing thoughts of the Internet	23.6	23.1	12.4	13.1	27.8
11. Find yourself anticipating when you will go on-line again	21.5	25.7	13.1	17.5	22.2
12. Fear that life without the Internet would be boring, empty, and joyless	9.1	10.5	10.0	14.7	55.6
13. Snap, yell, or act annoyed if someone bothers you while you are on-line	13.6	26.2	14.0	17.1	29.2

14. Lose sleep due to late-night log-ins	22.9	25.7	17.8	12.6	21.0
15. Feel preoccupied with the Internet when off-line, fantasize about being on-line	36.2	21.7	15.0	12.1	15.0
16. Find yourself saying “just a few more minutes” when online	7.9	18.7	16.1	15.2	42.1
17. Try to cut down the amount of time you spend on-line and fail	16.1	20.3	12.6	17.5	33.4
18. Hide how long you’ve been on-line	25.2	27.8	17.8	16.4	12.9
19. Spend more time on-line over going out with others	43.5	22.9	14.3	12.1	7.2
20. Feel depressed, moody or nervous when you are off-line, which goes away once you are back on-line	39.5	24.1	12.6	10.7	13.1

In comparison to average users, possible addicts/internet addicts found dramatically more often or always in all the situations mentioned in Table 5. Out of 147 possible addicts/internet addicts, 83% found themselves saying often or always “just a few more minutes” when online, almost 78%

often or always feared that life without the internet would be boring, empty, and joyless and nearly 48% often or always lost sleep due to late-night log-ins. Thus, the study revealed possible addicts/internet addict students were highly dependent to internet.

Table 5: Comparison between Average Users and Possible Addicts/Internet Addicts by IAT

Situations (Note: 4-5 = Often/Always)	Average users	Possible Addicts/ Internet Addicts
	(4-5) %	(4-5) %
Stay on-line longer than intended	14.6	57.1
Others in life complain about the amount of time spend on-line	12.1	63.3
Block out disturbing thoughts about life with soothing thoughts of the Internet	12.1	57.8
Find yourself anticipating when you will go on-line again	4.6	55.8
Fear that life without the Internet would be boring, empty, and joyless	44.1	77.6
Snap, yell, or act annoyed if someone bothers you while you are on-line	12.8	60.5
Lose sleep due to late-night log-ins	7.1	47.6
Find yourself saying “just a few more minutes” when online	20.6	83.0
Try to cut down the amount of time you spend on-line and fail	15.7	67.3

DISCUSSION

Numerous studies have explored the relationships among heavy Internet use, social-psychological factors, and computer-related factors.⁷ In Young’s study⁸, compared to the 5 hours of non-dependents, internet addicts reported a striking average of 39 hours per week spent online. Similarly, Chen and Chou (1999) reported the high-risk group spent an average of 20 hours per week online; the non-high-risk group spent about 9 hours online.⁷ From this survey, possible addict/internet addict students were found to spent average of 34 hours per week, compared to the 11 hours of average users.

Several studies have indicated that gender is one of the predicting factors in Internet addiction, that is, males are more likely than females to become Internet addicts.^{2, 7-9} This study also showed that male students were more possible addicts/

internet addicts than female students. Interactive online games and contents mainly rely on power, dominance, control, and/or violence, this may explain males attraction to internet use than females.⁸

Several studies indicate adolescents with IA were significantly more likely to have dysfunctional familial relationships.¹⁰⁻¹³ This survey also found statistically significant difference between average users and possible addicts/internet addicts based on their Family Characteristics.

A pilot study found there was significant difference between male and female addicts in association with the number of close friends ($p < 0.001$).⁴ In contrast, this study shows there was no significant difference between average users and possible addicts/internet addicts in association with the number of close friends but statistical significant

difference was seen based on the relationship with classmates ($p = 0.024$) similar to other studies.^{14,15}

Additionally, from this survey it reveals, 83% of possible addicts/internet addicts find themselves saying often/always “just a few more minutes” when online, almost 78% often/always fear that life without the internet would be boring, empty, and joyless, 67.3% often/always try to cut down the amount of time you spend online and fail, more than half of them (57.1%) stay online longer than intended. Thus, this shows possible addicts/internet addict students are highly dependent to the internet. A study conducted in US in University students, sleep deprivation and general physical complaints are considered associated features of Internet addiction.¹⁶ Similarly, this survey reveals nearly 5 in 10 possible addicts/internet addicts often/ always lose sleep due to late-night log-ins.

Dr. Young study has concluded that suspected cases of Problematic Internet Use (PIU) should undergo depression assessment.³ Although it is not evident whether depression leads to the development of internet abuse or it is a consequence, yet assessment of the same is imperative.² Young showed that withdrawal from significant real-life relationships is a consequence of pathological internet users.³ Nemiz et al. study showed that students with PIU had low self-esteem and were socially inhibited online.²

Dr. Kimberly describes common signs and numerous effects of Internet addiction, however, the diagnosis of Internet addiction can be challenging.³ Considering so many practical uses and several direct benefits of the Internet for advancement in this modern world, signs of addiction can be potentially masked. Thus internet can escape the criticism of being addictive, which makes it an emerging issue worldwide.

More than 30 million Internet gamers were said to be addicted in China. It was considered as an epidemic, and to battle this problem Internet cafes were regularly shut down and those illegally operated were charged huge fines for their operators, laws were introduced to restrict the number of hours adolescents can play online games and the first treatment center for Internet addiction was opened in Beijing in 2005.⁷

Overall, majority of the researches have targeted adolescent population, and results concerning the prevalence of Internet Addiction among adolescents are significant. Majority of the researches worldwide reveal about the effects of IA on mental health focusing on the adolescent population and advocate about drawing attention on this issue.

CONCLUSION

Although Internet addiction is a relatively new phenomenon, it has already become a subject of numerous studies. Internet penetration rate is gradually rising in Nepal, but the study on Internet Addiction has not yet been prioritized. Thus, this study is a preliminary step toward understanding the extent of internet addiction among +2 level students in Kathmandu district. The prevalence of internet addiction among higher secondary level students according to this survey was 2.57 with internet penetration rate 97.3%. The possible addicts/internet addict students were found to spent average of 34 hour per week, compared to the 11 hours of average users. Male students were more possible addicts/internet addicts than female students. The purpose of internet use was majorly for social networking and entertainment. This survey reveals that more than half of the respondents have heard of Internet Addiction i.e. 284 (64.5%), whereas, the rest 46 respondents i.e. 35.5% have not heard of Internet Addiction. Among those who heard of IA, 83.8% were not aware of the effects of IA. However, the results cannot be generalized at large and cannot represent all age group of adolescents. Thus, further research studies are required to understand the underlying mechanisms of internet addiction and its various factors and to explore effective preventative or interventional strategies.

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A Comparative Study on Community Based DOTS service and Health Institution Based DOTS service among TB Patients

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ABSTRACT

Tuberculosis (TB) is the most problematic and highly prevalent communicable disease affecting about one-third of the world's population and debilitating pulmonary (PTB) infection today. In spite of all these efforts by the government of Nepal, many people still die every year and transferring the disease to the healthy person. The new approach for the effective treatment of tuberculosis has been introduced i.e. Community Based Directly Observed Treatment Short Course (CB-DOTS) which provides training to community health workers to increase awareness, detection, and treatment of TB and bring services directly to the homes of those at risk for infection and those who are infected. The aim of this study was to compare availability, accessibility, compliance and satisfaction between CB-DOTS service and health institution based DOTS (HI-DOTS) service among TB patients. A cross sectional study was carried out in Kaski and Tanahun district in 2014. Census was conducted for the TB patients who are registered during 6 months in the community based DOTS with same number and same time period, that had been enrolled in DOTS from health institution were chosen. The collected data was entered in EPI-DATA and analyzed by using the software SPSS-16. In HI-DOTS the average traveling time to get TB drugs is ≤ 30 minutes for 56.8 percent respondents and in CB-DOTS majority of the respondents; 90.9 percent have to travel ≤ 30 minutes. In HI-DOTS majority; 84.1 percent were dissatisfied and only 15.9 percent were satisfied. Just opposite to this, majority (81.8%) of respondents utilizing CB-DOTS service were satisfied and only 18.2 percent were dissatisfied. There is highly significant association between the patient's satisfaction and two different DOTS services ($p < 0.001$). CB-DOTS service approach shows its better effectiveness in availability, accessibility, compliance and patient's satisfaction aspects. CB-DOTS is a viable option and can complement and strengthen the existing HI-DOTS, especially in developing countries like Nepal where the health system is overwhelmed with increasing number of TB patients and high TB related deaths.

Key words: Community Based Directly Observed Treatment Short Course, Availability, Accessibility, Satisfaction

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INTRODUCTION

Tuberculosis (TB) is an endemic communicable disease which is the problematic worldwide and mostly in many developing countries as it is directly related to poverty and nutrition, and on other hands efforts at eliminating the disease also remain very unsuccessful although many efforts from the past have been attempting to change the situation.¹

After adoption of the new Stop TB strategy in 2006, NTP has implemented all six components (i.e. pursue high quality DOTS expansion and enhancement, address TB/HIV, MDR-TB and

other challenges, contribute to health system strengthening, engage all care provider, empower people with TB and communities and enable and promote research) to reduce the burden of TB and achieve Millennium Development Goals and STOP TB partnership targets by 2015.²

Stop TB partnership target assumes that by 2015 the global burden of TB (disease prevalence and deaths) will be reduced by 50% relative to 1990 levels. The number of people dying from TB in 2015 should be less than about 1 million, including those co-infected with HIV. Similarly, by 2050 the

global incidence of TB disease will be less than 1 case per million populations per year.³

Tuberculosis represents, according to World Health Organization (WHO), one of the most leading causes of death worldwide. With nearly 8 million new cases each year and more than 1 million deaths per year, tuberculosis is still a public health problem.⁴ About a third of the world's population is estimated to be infected with tubercle bacilli, and hence at risk of developing active disease and in developing countries, TB comprised 25% of all avoidable adult deaths.⁵

DOTS which have been successfully implemented since April 2001, is the patient - centered approach ensuring that they complete their full six months course of treatment and with the same objectives but with different perspectives and setting, community-based directly observed treatment, short-course (CB-DOTS) for tuberculosis was started from March 2014 in some part of the country which involves training of community health workers to increase awareness, detection and treatment of TB and brings services directly to the homes of those at risk for infection and of those who are infected.

NTP in 2006 after adoption of the new Stop TB strategy to reduce the burden of TB and achieve Millennium Development Goals and STOP TB partnership targets by 2015 planned with different components and strategies. The case finding rate of new smear positive TB cases was 77.5% which was more than 4% compared to the achievement of last year and case notification rate is 55.41/100k population.²

Nepal's commitment to achieve and sustain the Sustainable Development Goals by 2035 by 2015 has pushed policy makers, programme managers and practitioners to take more aggressive tuberculosis (TB) control measures. Introduction of DOTS has already reduced the number of deaths from TB; however, 5,000-7,000 people still die every year.⁶

With a population of about 27 million, Nepal had an estimated incidence and prevalence rate of all forms of TB of 163 and 241 per 100000 populations, respectively, in 2012. The notification

rates of all forms of TB and new smear-positive cases were 128 and 55, respectively, showing no significant change in the past decade despite sustained high case detection and treatment success rates, increased access to DOTS through decentralization of services, outreach projects and strong community involvement.⁷

For the purpose of increase in availability and accessibility of DOTS among vulnerable groups (disable person, ageing people, pregnant and children) of a society and population who are far from health institution, NTC has a piloted new intervention CB-DOTS. It is currently running in five different districts of each development region. Institutional DOTS has been running since around last two decades but still 5000-7000 people are still dying. About 45 percent of the total population is infected with TB and still 10,000 cases are missing. So all these problem should be minimized or reduced with new intervention/strategy as CB-DOTS. So this study was trying to compare the availability and accessibility of health care services, compliance to drugs and patient's satisfaction between CB-DOTS service and HI-DOTS service among TB patients.

The objective of this study is to compare the availability and accessibility of health care services, compliance to drugs and patient's satisfaction between CB-DOTS service and HI-DOTS service among TB patients.

METHODS

A cross sectional study was adopted to compare the availability and accessibility of health care services, compliance to drugs and patients satisfaction between CB-DOTS service and HI-DOTS service among TB patients. Quantitative method was adopted. All registered TB patients who were receiving DOTS treatment within in both CB- DOTS in Kaski district which is one of the first district to launch CB-DOTS programme and health institution based DOTS in Tanahun district who were on treatment was enrolled in the study. The study was conducted in different health institution of Tanahun district and home visit of the patients who were enrolled in community based DOTS service in Kaski district. Census was conducted for the TB patients who are registered

during 6 months (March 15, 2014 to September 16, 2014) in the community based DOTS service i.e. 44 patients and in the same number within the same time period that had been enrolled in DOTS from health institution were chosen. Five health institutions of Tanahun district were selected with maximum number of patients then according to number of patients in each health institutions the required sample which was equal in number to CB-DOTS service was selected proportionately. The proportion of the sample with the study population was 64 %. So at least 64 percent samples were drawn from each DOTS center. All TB patients who were under treatment in health institution based DOTS and CB-DOTS were enrolled. EPI-DATA was used for data entry and after exporting to SPSS 16.0 different statistical analysis had performed.

RESULTS

Most of the respondent's 44.3 percent were in between 20-39 years age group and it was found that the least 13.6 percent population comprises within less than 20 years of age. Out of total 88 from both DOTS patients 59.1 percent were female and 40.9 percent were male.

1. Assessment of the availability of the health care services

Table 1: Distribution of respondents by availability of health care services and DOTS service

Characteristics	DOTS	
	HI-DOTS n (%)	CB-DOTS n (%)
Availability of health worker/ treatment volunteer in every visit	(n=44)	(n=44)
Yes	44 (100)	44 (100)
No	0	0
Faced scarcity of drugs	(n=44)	(n=44)
Yes	0	0
No	44 (100)	44 (100)
Number of times patient supervised	(n=2)	(n=20)
1 time	1 (50)	4 (20)
2 times	1 (50)	12 (60)
3 times or above	0	4 (20)

Ever faced side effects by drugs	(n=44)	(n=44)
Yes	26 (59.1)	31 (70.5)
No	18 (40.1)	13 (29.5)

Among HI-DOTS 50 percent were supervised only one time and remaining 50 percent were supervised for 2 times. Similarly, among 20 respondent supervised in CB-DOTS 60 percent were supervised for 2 times, 20 percent for 1 time and remaining other 20 percent were supervised for 3 times or above.

The above table also shows that majority of the respondent from CB-DOTS 70.5 percent had faced some types of side effects by drugs and in HI-DOTS 59.1 percent respondent had faced side effects by TB drugs.

2. Assessment of the accessibility of the health care services

Table 2: Distribution of the respondents by accessibility of health care services and DOTS service

Characteristics	DOTS	
	HI-DOTS	CB-DOTS
	n (%)	n (%)
0.1625 in	(n=44)	(n=44)
Any time	5 (11.3)	1 (2.3)
Morning	31 (70.5)	40 (90.9)
Afternoon	8 (18.2)	2 (4.5)
Evening	0	1 (2.3)
Faced long duration time for seeking treatment services	(n=44)	
Yes	10 (22.7)	0
No	34 (77.3)	0
Waiting time	(n=10)	
< 1 hour	7 (70)	0
Up to 1 hour	3 (30)	0
Visit to treatment center/ treatment spervisorfor medication	(n=44)	(n=44)
Regular	32 (72.7)	35 (79.5)
Irregular	11 (25.0)	6 (13.6)
Never	1 (2.3)	3 (6.9)

For both of the DOTS patients the appropriate time to take TB drugs was morning time in which 70.5 percent HI-DOTS respondents and 90.9 percent CB-DOTS respondents included.

Only the respondents of HI-DOTS responded to the long duration time for seeking the treatment

services. 22.7 percent responded that they have to wait certain time for receiving the treatment services and remaining majority of the respondent 77.3 percent responded they didn't have to wait for seeking the services. Among 10 respondents from HI-DOTS who had to wait long duration for seeking services 30 percent had to wait up to 1 hour and 70 percent respondent had to wait for < 1 hour.

Among 44 respondents in HI-DOTS majority of the respondents 72.7 percent regularly visit the DOTS center, 25 percent visit irregularly and remaining 2.3 percent never visit to the DOTS center.

Similarly, in CB-DOTS among 44 respondents 79.5 percent regularly visit to treatment supervisor, 13.6 percent visit irregularly and only 6.9 percent respondent never visit to treatment supervisor/FCHVs. Among the total respondents from HI-DOTS who irregularly or never visit to DOTS center are provided drugs by their household member 82.4 percent, and remaining by health workers/FCHVs and others (friends). Similarly, in CB-DOTS 77.8 percent respondent who irregularly or never visit to treatment supervisor receive drugs at home by treatment supervisor and remaining 22.2 percent by house hold members.

3. Accessibility of health care services and DOTS service

Table 3: Association between accessibility of health care services and DOTS service

Characteristics	DOTS		χ ² (df)	P-value	OR (95%CI)
	HI DOTS (n=44)	CB DOTS (n=44)			
	n (%)	n (%)			
Appropriate travelling time to get treatment services					
≤ 30 minutes	25 (56.8)	40 (90.9)	13.24 (1)	<0.001**	7.60 (2.31-24.94)
Above 30 minutes	19 (43.2)	4 (9.1)			
Use of transportation media					
Yes	21 (47.7)	2 (4.5)	21.249 (1)	<0.001**	19.17 (4.12-89.16)
No	23 (52.3)	42 (95.5)			

*p<0.05, **p<0.001

The average travelling time to get TB drugs is ≤ 30 minutes for 56.8 percent respondents from HI-DOTS and for the CB-DOTS patients' majority of the respondents 90.9 percent have to travel ≤ 30 minutes and only 9.1 percent respondents had to travel > 30 minutes to receive treatment services (Table 3). Finding shows that there is high significant difference in the average travelling time between HI- DOTS and CB-DOTS service (p<0.001). Regarding the appropriate travelling time to had access to treatment services patients utilizing CB-DOTS were approximately 7 times more likely to travel long distance than patients

utilizing HI-DOTS service (OR 7.60; 95% CI 2.31-24.94).

More than one third of the respondents 47.7 percent from HI-DOTS use the different types of transportation media and only 4.5 percent of the respondents from the CB-DOTS use different transportation media to easy access to treatment service. The finding shows that there was high significant difference in use of transportation media between HI-DOTS and CB-DOTS (p<0.001). For patients utilizing CB-DOTS service were nearly 19 times more likely to use transportation.

4. Assessment of the patient's satisfaction regarding the DOTS services

Table 4: Association between the patient's satisfaction and DOTS services

Characteristics	DOTS		$\chi^2(df)$	P-value	OR (95%CI)
	HI DOTS	CB DOTS			
	(n=44) n (%)	(n=44) n (%)			
Satisfaction					
Satisfied	7 (15.9)	36 (81.8)	38.24 (1)	P<0.001**	23.78 (7.81-72.41)
Dissatisfied	37 (84.1)	8 (18.2)			

**p<0.001

The table 4 shows that out of total respondents in HI-DOTS majority 84.1 percent were dissatisfied and only 15.9 percent were satisfied. Similarly, in respondents utilizing CB-DOTS service majority 81.8 percent were satisfied and only 18.2 percent were dissatisfied. The finding shows that there is highly significant association between the patient's satisfaction and two different DOTS services ($p<0.001$). Regarding the satisfaction patients utilizing CB-DOTS service were approximately 23 times more likely to be satisfied to the overall DOTS treatment services than the patients utilizing HI-DOTS services.

DISCUSSION**Availability of health care services to the patients**

This study shows that 100 percent availability of health worker and drugs for the treatment purpose in both of the DOTS services which is similar to the study of Paudel DP (2006) based on only health institution based DOTS which shows that 97 percent availability of health workers and 99 percent availability of drugs which were necessary for the treatment purpose of the TB patients.⁷ The study reveals that 88.6 percent CB-DOTS patients were provided counseling and only 65.9 percent to HI-DOTS patients. A study based on CB-DOTS showed that only 58.41 percent patients were counseled on general information of TB.⁵ This difference is may be due to small sample size of comparable study.

This study shows that there is better availability of counseling on general information on TB, availability of supervision by higher authority to patients in CB-DOTS service in comparison to the HI-DOTS service.

Accessibility to health care services to the patients

This study shows that 90.9 percent patients from CB-DOTS have to travel less than 30 minutes which is 58.6 percent in HI-DOTS patients. This is due to available of treatment service within ward level within the periphery of 30 minutes travelling distance in CB-DOTS. A study based on CB-DOTS shows that 34.66 percent patients have to travel ≥ 30 minutes to have access to treatment service. The difference in percentage with this study may be due to large sample size of the reference study literature. But a study based on HI-DOTS shows that only 8 percent patient have to travel ≥ 30 minutes. This small difference may be due to selection of patients in randomization with less distance travelling to have access to treatment service.^{6,8}

In this study 47.7 percent patient from HI-DOTS have to use transportation media to reach to the treatment center but in CB-DOTS only 4.5 percent patient's use transportation media to have access to treatment service. This study also includes that from HI-DOTS patients' majority 38.1 percent have to pay less than 50 rupees daily and other 38.1 percent also have to pay more than 100 rupees per day and remaining in between them. A study based on HI-DOTS shows that 53 percent patients paid less than 10 rupees per day and remaining 47 percent paid more than 10 rupees.⁹

70 percent of the patients from HI-DOTS have to wait < 1 hour and remaining 30 percent have to wait up to 1 hour to have access to treatment service but in CB-DOTS patients have easy access to treatment services without any waiting time according to finding of this study. A similarity

was seen in the study based on HI-DOTS which shows 73 percent have to wait < 15 minutes and 27 percent wait for \geq 15 minutes.⁸

Patient's satisfaction in treatment services based on types of DOTS

The study shows that 81.8 percent patients from CB-DOTS were satisfied and only 15.9 percent patients from HI-DOTS were satisfied. The more satisfaction towards the service provided by CB-DOTS is because of patients centered approach through appropriate provision of counseling on TB, short distance for service access, less or no waiting time for treatment service and regular supervision.

CONCLUSION

Community Based DOTS service approach was best available for the purpose of counseling in general information on TB and patients supervision in comparison to Health Institution based DOTS service approach. TB patients on the CB-DOTS treatment option had better access with less travelling time, cost effectiveness and no problem of long waiting time period for the treatment service in comparison to the HI-DOTS patients. Similarly, patients from CB-DOTS were more satisfied in different aspects of availability of health care services and easy access to the treatment services in comparison to the patients in HI-DOTS service approach.

CB-DOTS service approach shows its better effectiveness in availability, accessibility, compliance and patients satisfaction aspects. CB-DOTS is a viable option and can complement and strengthen the existing HI-DOTS, especially in countries like Nepal where the health system is overwhelmed with increasing number of TB patients and high TB related deaths. The advantages experienced by patients who were utilizing their CB-DOTS service approach outweighed the disadvantage which was showed by the HI-DOTS service.

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Application of Social Cognitive Theory in Obesity Prevention: A Rapid Review

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ABSTRACT

Obesity, as a result of including the chronic positive energy balance, is associated with many chronic diseases. Prevalence of obesity is increasing worldwide, including in selected developing countries, from previous very low status. Association or causality of one or more constructs of social cognitive theory to prevent and control obesity is paramount for program interventions.

We searched titles and abstracts using End Note Software and then approached original articles in databases of PubMed, Google Scholar and Health Inter-Network Access to Research Initiative (HINARI) in English language published between Jan 1, 2000 and Jan 10, 2015. The articles included only when one or more of the constructs of social cognitive theory viz. reciprocal determinism, behavioral capability, observational learning, reinforcements, expectations and self-efficacy were examined quantitatively with obesity or overweight. The data from the articles were then summarized and interpreted.

Out of 90 accessed and reviewed full-text articles, 22 included in the review, mostly of which studies were conducted in developing countries. The review results showed that intervening the constructs of social cognitive theory was found effective in preventing obesities including childhood obesities. In studies where media campaign was added with social cognitive theory, logistic regression results demonstrated that behavior change was greater among women.

Self-efficacy and social support are the important constructs of social cognitive/learning theory to be effective and associated in obesity prevention, others remaining modest. It is suggested that the constructs are integrated with media campaign and ecological components when intervened.

Key words: Social, cognitive, obesity, overweight, behaviour, self-efficacy, physical.

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INTRODUCTION

Obesity is a burgeoning medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems.¹ People are considered obese when their body mass index (BMI) a measurement obtained by dividing a person's weight by the square of the person's height, exceeds 30 kg/m², with the range 25-30 kg/m² defined as overweight.² Obesity is now so common within the world's population that it is beginning to replace under nutrition and infectious diseases as the most significant contributor to ill health.

In particular, obesity is associated with diabetes mellitus, coronary heart disease, certain forms of cancer, and sleep-breathing disorders. Obesity as a measurement only accounts weight and height and neither it takes into account the morbidity and mortality associated with more modest degrees of overweight nor the detrimental effect of intra-abdominal fat. The global epidemic of obesity results from a combination of genetic susceptibility, increased availability of high-energy foods and decreased requirement for physical activity in modern society. Obesity should no longer be regarded simply as a cosmetic problem affecting

certain individuals, but an epidemic that threatens global well-being.² Social Cognitive Theory (SCT) states that learning occurs in a social context with dynamic and reciprocal interaction of the person, environment and behavior. Because of the unique feature of SCT that emphasis on social influence and its emphasis on external and internal social reinforcement – it considers unique way by which an individual acquires and maintains behavior whilst considering the social environment.

METHODS

Search Strategy and Selection Criteria

We searched PubMed, Google Scholar and HINARI for published articles from 2000 Jan 1 to 2015 Jan 10. The articles were searched, retrieved and managed by using EndNote (version X3) software. List of key words entered and outputs are shown in table 1.

Table.1: Search strategy and selection criteria

S.N	Search Item (Items found)
1.	social marketing, obesity OR overweight prevention {233}
2.	obesity OR overweight prevention, stages of changes, transtheoretical model {9}
3.	Theory of reasoned action, obesity OR overweight prevention, developing countries {5}
4.	obesity/overweight treatment, social cognitive theory {79}
5.	female obesity/overweight prevention, behavioral learning theory {12}

Screening and Data Extraction

Only published articles in English language and based on obesity in developing countries as well as some developed countries were reviewed. The data extraction was done manually (fig. 1).

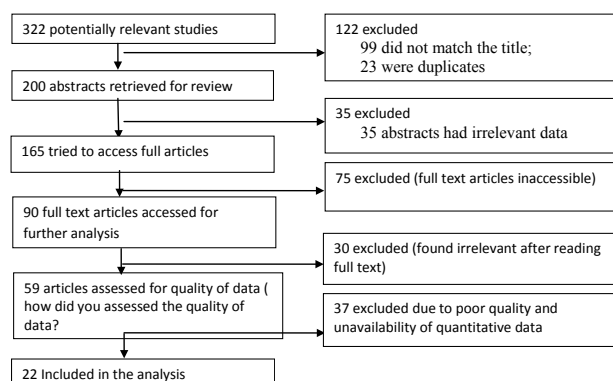


Fig. 1: Screening and data extraction

RESULTS

Nineteen interventional and three observational studies were reviewed. The sample size ranged from 22 to 15000. Interventional studies ranged from single group to randomized controlled trials, whereas observational studies included longitudinal and cross-sectional studies. Social cognitive/learning theory goes beyond behaviorism and thus corresponds to opening the black-box of human beings. It thus includes social learning and imitation, self-identity, thinking and rationalization. These constructs have been found mostly effective and associated in most of the studies (table 2).

Table 2: Study design, results and conclusions of 22 studies

Study	Model/ theory and constructs	Research/ Study design	Sample Size	Results (including statistic and p-value)	Conclusion	Remarks
Gray-Donald et al. ³	Social Learning Theory	Prospective interventional study	219	This intervention had only a minor impact on dietary behavior of the sample.	Finding ways of encouraging appropriate body weight and activity levels remains a challenge.	SCT was not found to be Effective.
Dewar et al. ⁴	Social Cognitive Theory model on, Adolescent Girls.	Interventional	235 Subjects	Current findings indicate a large proportion of the variance for physical activity and intention (28% and 34%) remains unexplained.	The proposed pathways in the SCT model were not fully supported	SCT was not found effective, may be of low sample size.

Dressler et al. ⁵	Social Cognitive theory on Urban Middle Aged women	Interventional	330 women's	Suggest that personal, behavioral, and self-identity factors can help to explain some weight variation observed among women living in similar obesogenic, low-income environments.	Results showed that only self-efficacy was associated with physical activity.	Integration of other models, that include ecological components, should be fostered.
Patrick et al. ⁶	Social Cognitive Theory on Young Adults	Randomized Control Trial	404 subjects	Theory-driven, evidence-based strategies for physical activity, sedentary behavior, and dietary intake can be embedded in an intervention.	Using social and mobile technologies to promote healthy weight-related behaviors in young adults is effective.	Mobiles and internet also serve as a effective interventional components in obesity prevention.
Sharpe et al. ⁷	Social Cognitive Theory Targeted on middle-aged women	Community-based intervention	2768 subjects	Women in the behavioral intervention had statistically significant (n=234, pre 822, post) (P-value < 0.001) positive changes. Media exposed women had statistically significant (P-value < 0.001) pre- to post program differences on knowledge of mapped routes.	No-intervention women had significant pre- to post program differences on physical activity minutes, walking, and knowledge of mapped routes.	Women must be exposed to medias for effective intervention implementation regarding obesity prevention and control.
Briley et al. ⁸	Social Cognitive Theory	Multicenter Randomized Control Trial	1546 subjects	Findings of this trial suggest that the lifestyle mediated improvement of glycemic control in obese pregnant women can minimize the risk of pregnancy complications.	Obesity is related with pregnancy complications as well.	SCT can be used as a method of preventing pregnancy complications too.
Castro et al. ⁹	Motivational interviewing grounded in social cognitive theory	Interventional	400 obese/overweight Latino smokers	Identified common mechanisms underlying change in smoking, physical activity, and diet used as treatment targets; identified practical models of patient-centered cross-cultural service provision	A practical example of how an intervention can be adapted to maximize relevance and acceptability and also maintain the core elements of the original evidence-based intervention	The intervention package was adopted from smoking cessation program.

Dewar et al. ¹⁰	Intervention, guided by Social Cognitive Theory.	Group randomized controlled trial with 12-month follow-up	357 adolescent girls	Significant between group differences in favor of the intervention group for self-reported recreational computer use (-26.0 min; 95% CI, -46.9 to -5.1), and sedentary activities summed (-56.4 min; 95% CI, -110.1 to -2.7), however objective sedentary behavior showed no differences	Intervention for adolescent girls in low-income communities significantly reduced time spent in sedentary activities. However, improvements in physical activity and hypothesized mediators of physical activity behavior were not observed	Intervention included enhanced school sport, lunchtime physical activity sessions, interactive seminars, nutrition workshops, to encourage physical activity and healthy eating, and a decrease in sedentary behavior.
Dewar et al. ¹¹	Multi component intervention guided by social cognitive theory	RCT, the Nutrition and Enjoyable Activity for Teen Girls (NEAT Girls) intervention.	357 adolescent girls	No intervention effects on BMI (adjusted mean difference -0.33, 95% CI= -0.97, 0.28, p=0.353) and BMI z-score (-0.12, 95% CI= -0.27, 0.04, p=0.178). However, there was a group-by-time interaction for percentage body fat (-1.96%, 95% CI= -3.02, -0.89, p=0.006). Intervention effects for physical activity, screen time, and dietary intake were not significant	The NEAT Girls intervention did not result in effects on BMI	Study of youth who are "at risk" of obesity should focus on strategies to improve retention and adherence in prevention programs.
Puma et al. ¹²	social cognitive theory	Quasi-experimental design comparing intervention and comparison cohorts	15,000	Long-term effects were observed in nutrition-related knowledge and attitudes but not self-efficacy or behavior change	It Had limited lasting effects when students have increased autonomy to make food choices.	Intervention can only be useful when subjects are given to autonomy to food choices.
Rosario et al. ¹³	Health Promotion Model and social cognitive theory.	Randomized trial	464 subjects	Children from intervention group reported a reduction whereas the control group reported an increase in solid LNEED foods consumption. The odds of increasing solid LNEED foods consumption was 0.48, 95%CI (0.24, 0.95) in the intervention schools.	Study provides further support for the success of intervention programs aimed at limiting the consumption of solid LNEED foods in children.	Intervention program were held by teachers previously trained in nutrition, on the consumption of low nutrient, energy-dense (LNEED) foods, of children attending elementary schools

Safdie et al. ¹⁴	Integration of ecological principles and Social Cognitive Theory (SCT) constructs	School-based obesity prevention program implemented in Mexico	15 schools	The most frequently used SCT construct within both intervention domains was Reciprocal Determinism (e.g., where changes to the environment influence changes in behavior and these behavioral changes influence further changes to the environment); no significant differences were observed in the use of SCT constructs across domains.	Promising combination of strategies and theoretical constructs that can be used to implement a school-based obesity prevention program	Strategies emphasized school-level infrastructure/ personnel change and strong political engagement and were most commonly underpinned by Reciprocal Determinism for both Nutrition and Physical Activity.
Smith et al. ¹⁵	Self-determination theory and social cognitive theory.	'Active Teen Leaders Avoiding Screen-time' (ATLAS) obesity prevention intervention in low-income communities	22	Primary outcomes were (BMI) and waist circumference. Secondary outcomes include BMI z-scores, body fat muscular fitness (grip strength and push-ups), screen-time, sugar-sweetened beverage consumption, resistance training skill competency, daytime sleepiness, subjective well-being, physical self-perception, pathological video gaming, and aggression.	ATLAS is an innovative school-based intervention designed to improve the health behaviors and related outcomes of adolescent males in low-income communities.	ATLAS can be used as an effective intervention for obesity prevention in developing countries as well.
Smith et al. ¹⁶	Guided by self-determination theory and social cognitive theory.	Cluster randomized controlled trial conducted in 14 secondary schools in low-income communities	361	No significant intervention effects for BMI, waist circumference, percent body fat, or physical activity. Significant intervention effects found for screen-time (mean +/- SE: -30 +/- 10.08 min/d; P = .03), sugar-sweetened beverage consumption (mean: -0.6 ± 0.26 glass/d; P = .01), muscular fitness (mean: 0.9 ± 0.49 repetition; P = .04), and resistance training skills (mean: 5.7 +/- 0.67 units; P < .001).	School-based intervention targeting low-income adolescent boys did not result in significant effects on body composition, perhaps due to an insufficient activity dose.	Intervention was successful in improving muscular fitness, movement skills, and key weight-related behaviors.

Leach et al. ¹⁷	Baseline nutrition intervention, grounded in Social Cognitive Theory	Intervention on blinded cohorts used on study participant in Mississippi public school students	22 volunteers of 57 eligible, overweight female	No pre intervention differences were found in height, weight, BMI, or age. Higher follow-up BMI scores were found in both groups, and. Gains in nutrition knowledge were sustained ($P < .002$); however, there was no association between nutrition knowledge and follow-up BMI ($r = -.185$; $P < .462$).	Minimal nutrition education alone may be an ineffective intervention for overweight children. Provides an example of how youth soccer may benefit overweight children	No significant differences between groups were found, possibly because of the small sample sizes and the short 8-week soccer intervention period
Lubans et al. ¹⁸	Social Cognitive Theory (SCT) assessed using a questionnaire.	Group randomized controlled trial on One hundred adolescent boys (mean age=14.3 (0.6) years)	100	Intervention had significant effect on resistance training self-efficacy ($p < 0.001$), but none of the SCT constructs satisfied the criteria for mediation. Changes in BMI were also associated with changes in resistance training self-efficacy ($r = -0.21$, $p = 0.06$) and physical activity behavioral strategies ($r = -0.29$, $p = 0.009$).	Intervention incorporating student leadership increased adolescent boys' resistance training self-efficacy, but changes in physical activity were not detected and none of the SCT constructs satisfied the criteria for mediation.	Baseline weight status was a moderator of intervention effect with the strongest intervention effects observed among overweight and obese adolescent boys.
Mastin et al. ¹⁹	Social cognitive theory framework	Observational	46 women	Although participants' primary weight-related obstacles were environment-based, for example, unsafe environments in which to engage in regular exercise, they more often offered individual-based solutions.	Discussion of media advocacy as a tool that can be used to promote environmental solutions.	Media advocacy can be used to increase effectiveness of interventions.
Mead et al. ²⁰	Social cognitive theory and Social ecological models	Community-based, multi-level intervention using formative research and a community participatory process.	246 adults	Respondents living in intervention communities showed significant improvements in food-related self-efficacy ($\beta = 0.15$, $p = .003$) and intentions ($\beta = 0.16$, $p = .001$) compared with comparison communities.	.More improvements from the intervention were seen in overweight, obese, and high socioeconomic status respondents.	Community-based, multilevel intervention is an effective strategy to improve psychosocial factors for healthy nutritional behavior change to reduce chronic disease in indigenous populations

Winett et al. ²¹	Social cognitive theory (SCT)	Internet-based intervention	-	The high use of the Internet provides a vehicle to reach different population segments with readily accessible, SCT-tailored long-term programs. Research studies using the Internet with tailored SCT interventions have shown changes in nutrition practices, physical activity, and weight loss for up to a year	One promising approach to weight gain prevention in population segments is the development and wide spread use of longer-term Internet programs using specific principles and procedures from SCT.	More dynamic use of social cognitive theory (SCT) for developing programs to maintain health behavior changes is emerging with some evidence of long-term maintenance
Li et al. ²²	Social cognitive theory	Cross-sectional survey	2400 children	15.2% of children were overweight and 10.9% were obese; nearly 80% of children spent inverted question mark 2 hrs./day either on physical activities or screen time.	Screen time is independently associated with childhood obesity, and needs be focused for obesity prevention in school-aged children in China.	Compared with those spent >3 hrs./day on screen time, children who spent inverted question mark 2 hrs./day or between 2-3 hrs./day were significantly less likely to be obese after adjusting for other variables
Neumark-Sztainer et al. ²³	Social cognitive theory	Cohort study performed	201 girls	The two strongest and most consistent factors associated with change in physical activity were time constraints and support for physical activity from peers, parents, and teachers	Effectiveness of interventions aimed at increasing physical activity among adolescent girls might be enhanced by engaging support from friends, family, and caring adults which may help in obesity prevention	Physical activity is an important component of a healthy lifestyle, with implications for the prevention of chronic diseases and obesity.
Arikan et al. ²⁴	Social cognitive Theory	Randomized control trial	2,038 subjects	Of the total participants, 85.2% learned about the "Fighting-Obesity Campaign" through television, 28.1% through radio, 11.0% from newspapers, 6.0% from billboards, and 19.2% from other sources. Study revealed that 28.5% of the participants adopted desired behavioral changes after exposure to campaign. Logistic regression demonstrated that behavior change is greater on women.	Media campaigns may cause behavioral changes by increasing motivation to prevent obesity within the target population.	Continuing these types of campaigns can lead to success at the national level too.

DISCUSSION

Types of obesity prevention interventions targeting social relational constructs and characterized by the degree to which these interventions have addressed key social relational constructs in intervention design and implementation play importantly in overweight and obesity. Social cognitive theory does not propose that increasing self-efficacy will inevitably result in behavior change²⁵. The theory states that the effects of self-efficacy on behavior will be moderated by outcome expectancies, i.e. beliefs that a particular behavior will lead to a particular outcome. Where an individual believes that the behavior will not lead to a valued outcome, self-efficacy will not motivate behavior change. For example, an individual may believe they can drink fewer alcoholic drinks, but if they do not think the amount they are drinking is harmful, such self-efficacy will not result in less consumption. In terms of the present review, obese individuals do not believe that increasing their physical activity will lead to weight loss, which presumably would be a highly valued goal. There is evidence that the relationship between increased physical activity and weight loss is far from straightforward²⁶, so that this would be reasonable outcome expectancy for many obese people. Thus, this population may be convinced by an intervention that they can increase their physical activity, but if they were not convinced that this would result in the salient outcome of weight loss, it would not necessarily result in increased physical activity. Apart from this only the construct “self – efficacy” of social cognitive theory has been widely used in many of its interventions.²⁷ In this study media campaign was launched grounded in social cognitive theory logistic regression results demonstrated that behavior change is greater among women.²⁴ There were a range of outcomes found in the set of interventions. Obesity-related outcomes included (1) anthropometric indicators, such as body mass index or body fat percentage, (2) physiological measures of cholesterol, blood pressure, and blood sugar, and (3) behavioral risk factors such as physical activity, dietary patterns and knowledge, screen time, sedentary time, and smoking. A number of studies included psychological and psychosocial outcomes, such as depressive symptoms, self-

efficacy, and motivation, while some studies also included social indicators, such as social support. Furthermore, the frequent reference to self-efficacy in the selected interventions requires additional attention. Self-efficacy; which comprises an individual’s motivation, locus of control, behavioral choices, intentions, and actions with respect to their goals, tasks, and challenges; was often included as a predictor, mediator, or moderator of overweight and obesity risk factors and status. The theoretical emphasis on personal responsibility and control belies the use of concepts related to social, political, and organizational change.²⁸ This is not to detract from the value of individually oriented theories.²⁹ However, mounting evidence suggests that innovative strategies for addressing and preventing obesity at a population level should entail theories and approaches that operate from an ecological perspective.³⁰ Integrative research review applying Stetler’s model of research utilization also revealed that constructs of social cognitive/learning theory are effective in eight out of ten studies to prevent and treat childhood obesity among four to 14 years children.³¹

CONCLUSION

Self-efficacy and social support are the important constructs of social cognitive theory in obesity or overweight prevention or maintaining normal body weight. Other constructs remained to be modest even among the children. Media effects and ecological components add the effectiveness.

RECOMMENDATIONS

It is recommended that ecological components like media campaign or internet should be integrated with any of the constructs such as self-efficacy and social supports, when applying social cognitive theory to prevent obesity or overweight. Internet is becoming even a more useful tool in such.

AUTHORS’ CONTRIBUTIONS

CA developed the review guideline and oversaw all aspects of this study. AP, DT, RT, SM and SG retrieved the articles; extracted data; summarized findings; and prepared the draft manuscript. AP reviewed and provided the valuable feedback. All authors provided valuable contributions to the

development and refinement of the manuscript including intellectual content. CA reviewed and incorporated the feedback and prepared the final manuscript. All authors read and provided approval of the completed manuscript.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

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