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Research Protocol

Public Health Section

Proposed Expert System for Controlling Obesity and Overweight Issues among Urban and Semi-urban School going Children: An Epidemiological Study

ANCHAL GARG[1], MADHULIKA BHATIA[2], MADHURIMA HOODA[3]

ABSTRACT

Introduction: The incremental swift pervasiveness and the associated health consequences, obesity is perceived as one of the most genuine health problems of the early 21st century. The predominance of obese and flabbiness expanded considerably over current decades. The reasons for stoutness are dramatic and multifactorial. Research on childhood obesity has shown the role of race, ethnicity, and social factors, for example, family income, family structure, and community protection.

Aim: To devise an expert system that will provide timely educational resources to the children, parents and schools to educate about the impact of junk food, low physical activity and poor lifestyle, as well as effect of excessive weight on overall health of a person in the form of short videos.

Materials and Methods: To create an expert system data will be collected, preprocessed and analysed statistically. Sample schools from urban and semi-urban regions would be identified for the study. Data from various sources will be integrated for better data analysis and a questionnaire will be structured to assess subject readiness. After assessing web-based and mobile-based expert system will be developed for counseling and bringing awareness on behaviour and lifestyle of the participant.

Conclusion: The diet of kids is a serious concern now-a-days. The obesity leads to health concerns especially among even in the younger generations aging 5-12 years. There is an urgent need of system that can automatically track obese stages and recommend appropriate diet.

Keywords: Data analysis, Diet recommendation, Heath issues, Recommendation system

INTRODUCTION

Obesity is caused when energy intake is more than the energy spent for prolonged period. The major factors influencing obesity are food intake and the extent of physical activity [1]. Interfaces amongst natural effects of obesity includes congenital traits, age, dose and drug, bottle as countered in breastfeeding, co-morbidity and social connections, as well as lifestyle for instance, eating structures, physical movement levels and screen time [2]. In addition to individual characteristics and behaviour, the enduring ascent in obesity on a national level can be ascribed to cultural changes in dietary patterns, nourishment and refreshment accessibility, and less-dynamic traditions of life, which has moved the equalisation of energy ingestion and disbursement. This societal swing has implications for the health of a generation. Childhood obesity is coupled with major morbidity. Additionally, it is associated to obesity in adulthood and is a gauge of significant health concerns in initial adulthood [1].

Now-a-days, either most of the parents are working and they are busy in their schedule or if some are homemakers, they may lack awareness about effects of obesity. The diet of kids is a serious concern. Mass media and attractive advertisements on television show junk food only, leading to missing nutritional diet and causing abnormal weight issues in children, mainly in the age group of 5-12 years. Such a diet leads to serious health issues like heart attack, diabetes, high level of cholesterol, vitamin deficiencies at an early age [3].

Moreover, children are becoming technical geeks and moving far away from physical activities, which have its own meaning in building good health in kids. At home also, they are gadget lovers, spending their time with mobile, tablets, laptops, and computers. All these have zeroed down the physical activities among children and further added to weight gain and associated issues. Abnormal weight and related health issues have become a global concern. Several agencies are seriously working to combat childhood obesity [3].

Due to enormous health threats that develop due to overweight and obesity, it is essential to check that weight gain is tackled timely. There are several factors that are responsible for obesity and it varies across regions and cultures, hence it is important to identify the exact reasons for obesity among urban and semi-urban children. As children in these areas are more directed towards TV ads, electronic gadgets, junk food outlets, and comfortable lifestyle, it is important to target the children of these areas. A study conducted by LeBlanc AG et al., also suggested that there is a prevalence of overweight and obese conditions among children in urban areas. Also, an automated system is required that could be used by children and parents to monitor the weight and suggest changes. The system will also educate the children and parents about the ill-effects of junk diet, low physical activity and poor lifestyle. As quoted by researchers there is lack of national representative data on obesity in children from India [4].

Detection and timely intercession of obese and flabbiness is crucial in thwarting or prolonging the onset of chronic diseases. There is no web and mobile based expert system till date that can help manage weight and monitor health of children on a regular basis. There is no system that can provide on-time recommendation of a child's health. Till date no in-depth analysis has been done using variety of statistical, data mining and machine learning techniques.

This calls for a proposal will help us gather detailed information and help extract useful patterns related to childhood obesity and subsequently build a recommendation system for weight management. Thus, there is a requirement of an expert system that documents the health condition of the child and countless other factors and proposes diet, physical activity and anticipated

alterations in everyday life that a child should embark on for appropriate weight administration.

This expert system will evaluate behaviour and health condition of obese children and accordingly recommend diet, physical activity and lifestyle changes as well as regularly monitor weight, diet, physical activity, and health of such children. There are many software applications and mobile apps that either keeps track of the consumed calories or physical activities [5]. These are apps that a person may wish to use at their own wish. But our system would be integrated with the schools that would make sure that every child suffering from overweight and obesity gets timely attention and his health is regularly monitored. Only a fraction of apps recommend diet, but no app recommends the kind and duration of physical activity or suggests any kind of lifestyle changes for weight management. This expert system also suggests best practices such as taking stairs instead of lift; avoid sleeping just after consuming food, not watching Television (TV) while eating etc. This system will also prepare a patient readiness scale to identify the motivation of maintaining healthy weight and accordingly make recommendations. No system on weight management records any barriers. This system will consider the barriers to weight loss and accordingly provide recommendations. No system keeps record of various clinical tests of patients or recommends doctor's advice. This expert system will recommend clinical tests and ask for doctor's advice in case of abnormal conditions. The patients will upload their prescription and advice, which will be stored in the system and help in reminding about regular check-ups and further records the progress of his/her health. A Global Positioning System (GPS) enabled smart device, a wrist band would be created to track the physical activity of a child. This device will send data to the expert system that will keep record.

It is seen that people are not motivated towards maintaining healthy weight because of unawareness for ill-effects of obesity [6]. This expert system will provide timely educational resources to the children, parents and schools to educate about the impact of junk food, low physical activity and poor lifestyle, as well as effect of excessive weight on overall health of a person in the form of short videos. Such a resource will help to curb the behaviour and attitude of children. This knowledge base of an expert system will be based on expert advice of nutritionist and endocrinologists.

Our system will be capable of maintaining a complete record (body mass index, weight, height, dietary habits, physical activities, socio-economic status, health conditions) of children who are weighty and obese and make episodic supervising of the nutritional, corporeal commotion, weight and obesity status of such children. The system would be able to envisage the prospects of children who are at present not overweight or obese but might have such odds in the nearby future. This database will help the government to assess the trends in obesity over time. As this system will be integrated with schools, so the government can tackle the overweight and obesity issues at a national level.

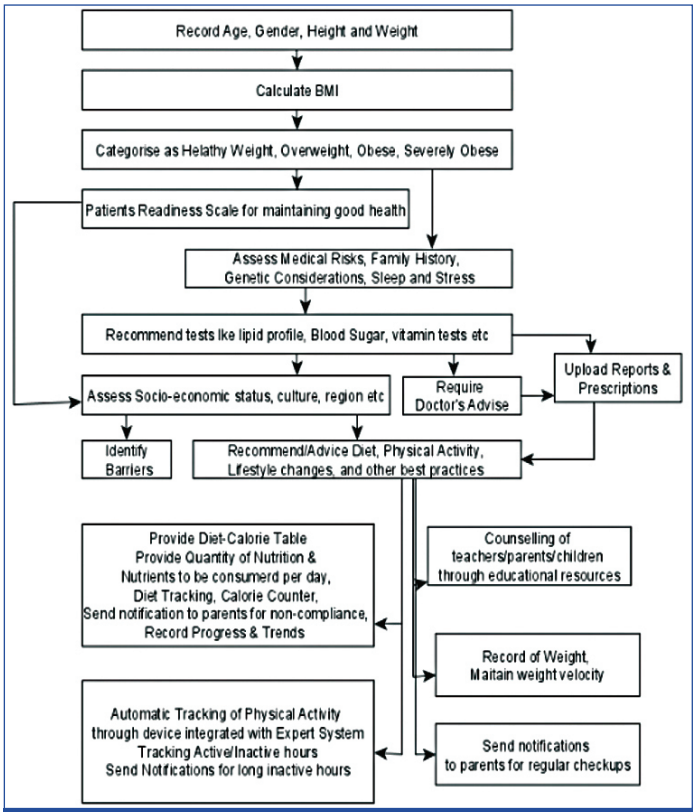
This project will conduct analysis on the dataset containing information regarding children suffering from overweight and obesity. The purpose is to identify the causes, health status and predict risks associated with obesity among children at the national level. The existing studies are limited to specific city, state, or region. But none have worked at national level. This study will provide the Indian scenario on the overweight and obesity issues.

The objectives of this expert system are to analyse the datasets to determine the distribution, causes and health status of children suffering from obesity and overweight at the national level, to predict group of children having high risk of acquiring serious health issue in near future, to predict group of children having high risk of gaining weight in near future, to assess major and minor co-morbid conditions among urban and semi-urban population and to develop behaviour management and lifestyle modification tool i.e., web-based and mobile based expert system for the children, parents, and schools.

MATERIALS AND METHODS

1. **Data analysis:** Data mining, statistical approaches and machine learning techniques
2. **Knowledge base:** Artificial Intelligence (AI) Programming Languages
3. **System development:** Expert System (ES) Engine, Java, Android

Data will be collected from various government agencies (as mentioned in the call). The target population will be the school children from the age group of 5-12 years belonging to urban and semi-urban areas. Sample schools would be identified for the study. Data will be pre-processed for missing values, inconsistencies, etc. Data from various sources will be integrated for better data analysis. A Questionnaire to assess patient readiness would be constructed. Web-based and mobile-based expert system will be developed to conduct counseling and modification of behaviour and lifestyle. Based on the results of analysis and domain expertise, a knowledge base would be built. The proposed operational system is shown in [Table/Fig-1].



[Table/Fig-1]: Proposed operational system.

STATISTICAL ANALYSIS

Statistical, data mining and machine learning techniques would be used for data analysis. The distribution of overweight and obese issues in the population their probable causes, difference among the health and unhealthy population, risks that are associated with such conditions will be studied and ways to control these will be identified.

DISCUSSION

Universally, there has been an escalation in childhood obesity in recent years. Two hundred million school children are either overweight or obese according to the foresaw statistics of the International Association for the Study of Obesity (IASO) and

International Obesity Task Force (IOTF). Now-a-days, obesity is considered as major wellbeing risk [7]. A study by Perrin EM et al., reviewed targets portraying a portion of the epidemiological aspects of obesity involving worldwide predominance, secular tendencies, threat factors, and burden of illness associated with obesity. The authors have established exceptional prominence on obesity fads in the United States and revealed worldwide precedents and hypothetical motivations for obesity [8].

Childhood obesity has several effects on adult health. In numerous countries studies have been carried out. A study has shown time trends and geographic comparisons that helped in identifying factors promoting obesity, in which a clarification of the different definitions is stated. The summary of nutritional status in children is given with recommendations [9]. The document has asserted to give a stage set of mechanisms for Member States to agree and discern essential areas for endeavor in the field of population-based impediment of childhood obesity. The tools offered are anticipated to assist a prioritising procedure that is equally order and locally pertinent. The World Health Organisation (WHO) stepwise system can be used for precluding compulsive diseases like obesity [10].

The present study encapsulates the obtainable information on current state of obesity among children. School-age populations in 25 countries and pre-school populations in 42 countries were investigated to find data for developments over time. The relevant data was obtained from the WHO, as well as other reports. WHO released a report in the form of a book on obesity, averting and controlling the worldwide pandemic. Report of a WHO consultation reviewed current epidemiological information on obesity to draw up recommendations on public health policies for preventing obesity [10].

Nguyen DM et al., reported that the prevalence of obesity has increased significantly in the US since 1980 and is associated with an increased risk of diabetes, cancer and other chronic diseases [11]. In a study, sample consisted of 5,844 children with 45.6% boys with a mean age of 10.4 years, from Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, the United Kingdom, and the United States [12].

Kass N et al., explored the ethical acceptability of measure, which restrict the sale of sweetened beverages in public schools in the United States. Their analysis suggested that although in the short term these measures were ethically defensible, in the long term there is a need for more widespread policy revision to combat obesity. The report on commission expressed and put an ethical obligation on all social orders to follow-up for the kid's benefit to decrease the danger of obesity via assortment of actions. Confronting childhood flabbiness evidently reverberates with the widespread acknowledgment of the privileges of children to a healthful life as appropriately as the responsibilities deemed by State Parties to the Convention of the Rights of the Child. There are also direct linkages to the Sustainable Development Goals (SDGs) through the spotlight on motherly and toddler health, and to the suggested Ecological Enhancement Targets [13].

Cunnigham SA et al., conducted a survey to measure the incidence of childhood obesity in United States. They reported that the incidence of obesity was more seen in young children, primarily in kindergarten [14].

In a study done by Gevers DW et al., they concluded that junk food and drink consumption is exceedingly ubiquitous amongst Dutch teenagers. Health campaign endeavours focusing on these deeds are merited and the present-day study may perhaps hasten these proposals. Focusing on youngsters with low-slung educated caretakers and on snacking back home after school poses the ultimate possibility to reduce junk food and drink consumption [15].

According to Wang Y et al., obesity is a lingering disease that is sharply correlated with an upsurge in impermanence and illness, involving specific categories of cancer, cardiac diseases, infirmity, diabetes mellitus, high blood pressure, osteoarthritis, and stroke. In grown-ups, obese is described as a BMI of 25 kg/m^2 to 29 kg/m^2 and corpulence as a BMI of weightier than 30 kg/m^2. If present trends persist, it is anticipated that, by the year 2030, 38% of the world's adult population will be overweight and another 20% obese. Substantial worldwide health approaches ought to slash the sickness and death rate linked with the fatness scourge [16].

WHO orientations harvest an overestimation in overweight and or obesity contained by this model of school children as contrast to the French allusions and the IOTF. The pre-eminence of comprehension coefficients among the three references count on both sex and age classes. The French references seem to be in close accord with the IOTF in delineating overweight, notably in children from age ranges between 7 years and 12 years [17].

CONCLUSION(S)

The output of this project would be the preparation of an integrated monitoring and follow-up tool for the categorisation, regular monitoring, lifestyle modification, counselling, follow-up and creating alerts for various problems related to obesity and overweight. This expert system would take into consideration various parameters and recommend diet and lifestyle changes for a child. The system will timely detect changes in children and suggest modifications in child's diet and behaviour to manage weight gain. This system can be integrated into the school routine culture so that regular monitoring could be done. The smart device- a wrist band can be used by children to keep track of their physical activity and regular alert will be sent to the parents on mobile for regular updates of their child's health status.

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PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Computer Science and Engineering, Amity University, Noida, Uttar Pradesh, India.
2. Associate Professor, Department of Computer Science and Engineering, Amity University, Noida, Uttar Pradesh, India.
3. Assistant Professor, Department of Computer Science and Engineering, Amity University, Noida, Uttar Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Madhulika Bhatia,
Sector 125, Noida, Uttar Pradesh, India.
E-mail: mbhadauria@amity.edu

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