**Combating Childhood Obesity in South India through an Innovative Tech-Driven Solution**

INFO 5637: Medical Informatics

Department of Information Science, University of North Texas

Instructor: Dr. Ana Cleveland & Dr. Raja Avinash Potula

Group-10

Satya Sri Manepalli

Vineela Jonnalagadda

Vemula Padmaja

**Team Contributions**

1. **Satya Sri Manepalli:** Worked on gathering literature review on and contributed to finding information on the mobile applications available in South India for addressing Childhood Obesity. Kept full efforts in designing technology solution diagrammatic illustration part. Took part in reviewing the project report and making it ready for submission.
2. **Padmaja Vemula:** Performed background research in selecting the project topic and community to apply the proposed solution. Reviewed the literature to extract statistical information on the population chosen. Worked on creating a table on existing technology solutions that are available on mobile in South India. Structured and organized the proposed technology solution part in this document including its description, implementation methodology, limitations, and conclusion. Aligned all the text and references. Made all the necessary changes while performing the final review of the project report.
3. **Vineela Jonnalagadda:** Worked on collecting background information on disease. Collected and organized the gathered information on chosen community, and existing awareness programs in India to fight childhood obesity. Double-checked the alignment of the document and worked on citing references in APA 7th edition format.

**Description of Chosen Community**

The UNICEF's World Obesity Atlas for 2022 reported that over 27 million children in India which means one-tenth of the children population worldwide will be obese by the year 2030. The financial expenses for obesity and overweight were expected to rise from $23 billion in 2010 to $479 billion by 2060. In terms of obesity, India ranked 99th out of 183 countries. In this paper we will be focusing on children in South Indian states who attend private schools between the ages of 5 and 16 since our literature review revealed that increased urbanization resulted in significant changes in lifestyle resulting in an increasing risk of obesity especially in children and limited research was performed in south states addressing obesity in children.

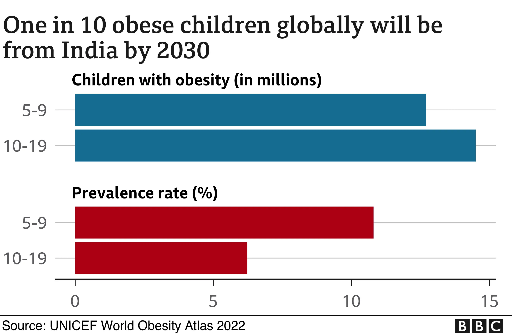


Figure 1: <https://www.bbc.com/news/world-asia-india-62307784>

According to the statistics obesity rate in India has increased substantially over the last few decades, going from 4% in 1975 to 18% in 2016. Recent research studies on children in the southern part of India revealed the incidence of overweight and obesity over there. A cross-sectional survey conducted on students in Kerala private schools found the total incidence of overweight and obesity was 21.2% (Viswambharan & Abraham, 2021). Furthermore, Gautam and Jeong (2019) performed a study on selected students in Karnataka and observed that 10.8% of the students were overweight and 6.2% of them were obese.

One of the main ways that South India is recognized internationally is through its cuisine, which is abundant in the five major Indian states of Tamil Nadu (TN), Karnataka (KA), Kerala (KL), Andhra Pradesh (AP), and Telangana (TG). In South India especially, food and traditions have a significant interdependent relationship. South Indian cuisines appear to be holding onto many of the elements of the ancient Dravidian food culture, even though the Dravidian civilization of South India was much more primitive than the rest of Indian civilizations (Parthasarathi et al., 2022).

Due to favorable climatic conditions like adequate rainfall, abundant rice crop yield is available in South India which is rich in carbohydrates. The food cuisine of South Indian states is rich in spices, split lentils, milk, coconut, and seafood. These states are also well-known for their variety and mouth-watering food flavors. The possible reason for childhood obesity in these states was due to the use of highly saturated fatty oils like coconut, gingelly, sunflower, and ghee to prepare high-calorie foods like deep-fried snacks and desserts including high sugar content (Parthasarathi et al., 2022).

Apart from the above mentioned cultural and regional food habits the increased urbanization in India resulted in major lifestyle changes in the population. In a PAN India survey conducted by the Centre for Science and Environment (CSE), 13,274 children ages 9 to 14 reported eating 93% packaged food, 68% packaged sugar-filled beverages more than once a week, and 53% packaged food at least once a day. These findings are reported by Singh S et al (2021b). Additionally, a quarter or so of school-age children consume more than once a week highly processed meals like pizza and burgers from fast food restaurants, which are heavy in sugar, salt, and fat.

**Background Information on Health Problem**

According to the World Health Organization, obesity is a complex chronic illness caused by the buildup of extra fat in bodily tissues, compromising health. A person is considered overweight if their BMI (body mass index) is more than 25 and obese if it is more than 30. Weight in kilograms divided by height in meters squared yields the body mass index, or BMI (kg/m2).

Over the last forty years, the global rate of childhood obesity has doubled among children ages 2-4 and increased by a factor of eight for those aged 5-19 (Di Cesare et al., 2019). If current trends continue, India's share of the global childhood obesity burden is expected to be approximately 11% by 2030. The incidence of obesity among children and adolescents as of 2022 is four times greater than levels recorded back in 1990, according to data by the NCD Risk Factor Collaboration (NCD-RisC), an international group of experts collaborating with the World Health Organization (WHO).

India is experiencing a triple burden of malnutrition, stunting, wasting, and micronutrient deficiencies in addition to an increase in childhood obesity and overweight. The prevalence of overweight and obesity in India is rising at a faster rate than the global average (Luhar et al., 2020). India is a developing nation that has attained a fleeting condition of undernutrition because of poverty and obesity brought on by the industry's rapid urbanization.

One of the most neglected health issues that contribute to diabetes, high blood pressure, cholesterol imbalance, sleep disturbances, liver disorders, in female child menstrual irregularities, metabolic syndrome, and cardiovascular disease is obesity which is a good predictor of overall health and nutritional status. The three main elements influencing weight management and pediatric obesity are genetics, developmental influences (also known as "metabolic programming," or epigenetics), and environmental factors (Nadiger et al., 2022).

Adolescence is the transitional period between the ages of 10 and 19 before puberty and adulthood. During this stage of development, adversity can have a significant detrimental effect on health by raising the chance of long-term illness and death. The current period is defined by notable changes in several lifestyle characteristics, including food patterns, psychological elements, physical inactivity, and sedentary behaviors that affect weight maintenance and contribute to childhood obesity. To encourage a healthy lifestyle, it is essential to gain knowledge of these variables and take the necessary action. Childhood obesity is a medical condition that affects a large number of youngsters and is a serious barrier to public health. Children who are obese have a higher likelihood of developing this illness as adults, which raises their risk of developing further severe health problems.

**Existing Solutions Available**

Children, particularly those at risk, should eat a well-balanced diet that includes plenty of salads and vegetables, and avoid force-feeding and frequent snacking. Physical exercise, defined as at least 60 minutes of moderate to intense activity on most days, is critical in lowering obesity risk.

Regular meals, family mealtimes, and restricted screen time are all stressful.   
Furthermore, family participation in developing healthy habits, such as regular meals and physical activity, is critical. Schools have an important role in managing food choices and integrating physical activity into the curriculum.

For obese children, a comprehensive weight loss program suited to their specific needs, including motivation, family support, and progressive modifications, is recommended. This program takes a multidisciplinary team approach and seeks to enhance metabolic outcomes.

1. **Existing Awareness Programs in India on Childhood Obesity:**

The health ministry is working with the education ministry to implement the school health and wellness program under Ayushman Bharat. The program aims to train two teachers per school (preferably one male and one female) as "Health and Wellness Ambassadors" to disseminate health promotion and disease prevention knowledge on topic areas every week to promote the joy of learning. The conceptual areas covered are growth, health and hygiene, nutrition, and the promotion of healthy lifestyles (Initiatives to Control the Incidence of Overweight and Obesity, n.d.).

The maximum amount of trans fatty acids allowed in oils and fats is 2%, as determined by the FSSAI. Similarly, 2% of the total weight of edible oils and fats in food items is the limit for trans fatty acids. The first day of 2022 will see the implementation of these restrictions. To promote healthy eating habits and safe food for children, the FSS (Safe Food and Balanced Diets for School Children) Regulations, 2020 were released. Food products high in saturated fat, trans fat, added sugar, or sodium (HFSS) are not permitted to be served to students in school canteens, mess halls, dormitory kitchens, or within fifty meters of schools (Initiatives to Control the Incidence of Obesity, n.d.).

1. **Existing Technology Solutions in India on Childhood Obesity:**

The world of today is radically different thanks to significant technological breakthroughs. With its broadened application in the healthcare industry, artificial intelligence is showing promise in the areas of medicine, diagnostics, and therapies. When it comes to technological remedies for obesity, a plethora of smartphone applications have been created to inspire people about the value of activity and healthy eating.

Furthermore, active video games blend fitness and video gaming, were developed recently encouraging youngsters to be physically active by adding movement into the gameplay. Examples include "Let Us Move" programs and Zamzee applications. Mobile phones are widely available and can communicate with wearables and sensors, allowing for real-time tracking of physical activity and food. These tools can monitor behavioral and physiological changes, providing useful information to healthcare professionals and researchers. Machine learning-based methodologies are rapidly being utilized to predict and diagnose numerous chronic illnesses, including obesity. However, there is a scarcity of comprehensive evaluations concentrating solely on ML applications for childhood obesity control. Social robots are embodied agents with human characteristics that have shown promise in providing personalized care to children.

They can improve behavior and motivation by engaging in bodily engagement, emotional expression, and companionship. Despite the usefulness of these technologies, more extensive evaluations are needed, specifically to compare the efficacy of robots and AI-based techniques to other technology-based therapies in the management of childhood obesity (Alotaibi et al., 2022).

Some of the mobile applications include Nutrify India Now, a diet tracking app launched in India at Hyderabad by IT start-up Macronel which is used to track the intake of food and gives information about the number of calories, vitamins, and protein intake in the body and plans healthy meals, creating shopping lists, and tracking their daily food intake. The app could offer personalized meal suggestions based on dietary preferences, restrictions, and nutritional goals (food navigator-asia.com, 2018).

While there isn’t a specific app solely dedicated to controlling obesity, these government programs and initiatives collectively contribute to raising awareness, promoting healthy lifestyles, and preventing obesity in India. Additionally, some hospitals, like JJ Hospital in Mumbai, are considering establishing exclusive outpatient departments (OPDs) for children and teenagers to address childhood obesity and start a website to address the problems regarding food habits and can directly communicate with the doctors free of cost (Nutra ingredients-asia.com, 2019).

Therefore, long-term treatment efforts and early preventative strategies are recommended. Integrating mobile ("mHealth") and digital ("eHealth") technology in pediatric weight-management treatments addresses gaps in care by providing accessible, low-cost solutions that are available anywhere at any time. Furthermore, innovative, "kid-friendly" programming like virtual reality and physical activity, as well as individualized aspects like momentary feedback and booster messages, can increase engagement with eHealth and mHealth technology.

Table:1

List of a few Mobile applications available in India to enhance fitness and incorporate a healthy lifestyle, especially in children:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Application Name** | **Age Rating** | **Modalities** | **Key Features** | **Subscription** | **Access link** |
| 1 | Little Joys: Kids Health App | 12+ | iOS & Android | Personalized diet Kids care, health & wellness, BMI Calculator, doctor advising | No | <https://play.google.com/store/apps/details?id=com.mosaicwellness.ourlittlejoys&hl=en_US&gl=US>  <https://apps.apple.com/vn/app/little-joys-kids-health-app/id1662152873> |
| 2 | Indian Weight Loss Diet | All | iOS & Android | Knowledge of Food & lifestyle for health maintenance, training online classes to mitigate obesity, diabetes, PCOS, PCOD, and other health issues, and tracking user progress. | Yes | <https://play.google.com/store/apps/details?id=com.iwldbyricha&hl=en&gl=US>  <https://apps.apple.com/in/app/indian-weight-loss-diet/id6462674579> |
| 3 | Zombies Run + Marvel Move | 12+ | iOS & Android | Storytelling feature to motivate, music playlists, GPS tracking, and maintain user stats | Yes | <https://apps.apple.com/us/app/zrx-zombies-run-marvel-move/id503519713>  <https://play.google.com/store/apps/details?id=com.sixtostart.zombiesrunclient&hl=en_US&gl=US> |
| 4 | Kids Exercise: Kids Workout | 4+ | iOS & Android | Yoga training, fitness routines, postures of the spine, new UI design, and everyday challenges | No | <https://apps.apple.com/us/app/kids-exercise-kids-workout/id1580602853>  <https://play.google.com/store/apps/details?id=com.yogaforkids.kidsexercise&hl=en_US&gl=US> |
| 5 | Khelo India | 5+ | iOS & Android | Provides information about various games, available sporting facilities, and fitness assessment of children | No | <https://apps.apple.com/in/app/khelo-india/id1440961562>  <https://play.google.com/store/apps/details?id=com.sportsauthorityofindia.kheloindiagames&hl=en_US&gl=US> |
| 6 | GoNoodle- Kids Videos | 4+  (4-12) | iOS & Android | Weekly video updates that include school content, focus on yoga, dance, and exercise | No | <https://apps.apple.com/us/app/gonoodle-kids-videos/id1050712293>  <https://play.google.com/store/apps/details?id=com.gonoodle.gonoodle&hl=en_US&gl=US> |
| 7 | Kids Workout for weight loss | 3+ | Android | Experienced fitness professionals, family’s workouts together, and safety assurance for kids | Yes | <https://play.google.com/store/apps/details?id=kids.workout.weight.loss> |
| 8 | HealthifyMe | 13+ | iOS & Android | Track over 55,000 foods & 1,500 exercises, and receive real-time insights, automated analytics on user health, and access expert advice from top coaches | Yes | <https://apps.apple.com/in/app/healthifyme-weight-loss-plan/id943712366>  <https://play.google.com/store/apps/details?id=com.healthifyme.basic&hl=en_IN> |
| 9 | Yoga for Kids & Family Fitness | All | Android | Fun animations are incorporated, challenges at different levels and provide nutrition tips | No | <https://play.google.com/store/apps/details?id=com.fitnessapps.yogakidsworkouts&hl=en_US&gl=US> |

**Proposed Technology Solution**

After a thorough literature search, we realized that there were no specific personalized technological solutions to address obesity in South Indian children belonging to the age group 5-16 years. Although there were many mobile applications available, none of them seemed to be integrated health records of the children. This made us come up with the idea to propose a solution to develop a personalized technological tool based on eHealth records of patients by using the concepts of Artificial Intelligence and data analytics in wearable technology and mobile health (mHealth) applications.

As mentioned in the earlier sections this innovative personalized mHealth application is proposed to address childhood obesity in South Indian private schools. This solution outstands the existing technical applications that provide basic generic fitness tracking and dietary suggestions by integrating the app into the school’s academic curriculum and by utilizing students’ health records to create tailored plans for each student based on their health history.

The key features of the proposed solution:

1. **Customized fitness**: The software generates specific exercises that are engaging and right for the student's age, based on the student's body mass index (BMI) and level of activity.
2. **Diet and Nutrition guidelines**: Meal plans that match regional food habits and nutritional requirements are provided by the app by working with nutritionists and local dietitians.
3. **Learning Modules**: Lessons include topics like proper eating habits, staying fit, and how to maintain a healthy lifestyle are included in these sections.
4. **Gamified Components**: Leverage portions of games to encourage children to adopt healthier habits, such as badges awarded for achieving nutrition and fitness goals.
5. **Wearables**: Fitness watches that are compatible with the mobile app should be recommended. Steps taken, calorie consumption, and total levels of physical activity can be tracked with the use of these appliances.
6. **AI and Data Analytics**: Analyze the information collected using machine learning algorithms to gain an understanding of dietary trends, exercise levels, and progress made toward health objectives. Optimizing recommendations and solutions for specific users can be facilitated by this data.
7. **Academic Integration:** This application will be included in physical education and health curricula in schools. Teachers can receive reports via the app on their student’s activities thus enabling them to give more individualized instructions.
8. **Parental engagement:** Features that allow parents to take an active role in their child's health goals by keeping an eye on their activities and progress.

**Explanation of how the Solution will address the Problem**

Personalized diet and physical activity recommendations will be generated by the app applying machine learning and data analytics depending on the user's age, weight, height, and health goals. This tailored strategy might turn out to be more effective than common health recommendations. Furthermore, activity can be greatly increased by gamification and real-time feedback, especially with younger users. Creating a gaming-like experience for wellness management may foster consistent involvement and adherence to healthy practices.

It is necessary for us to maintain consciousness of the significance of living a health-oriented life. Students can learn the value of a healthy diet and regular exercise in a fun and simply accessible way with the app's engaging educational material. By including parents and teachers, this strategy ensures that children receive sufficient help and support both at home and in school. This strategy is essential for long-lasting changes in students' lifestyle preferences.

Wearable gadgets and smartphone applications reduce barriers in recording data on health since they are readily available and simple to use. Because of the technology's flexibility, users can interact with the tools everywhere they go and at any time they choose. With the use of this technology, poor dietary or physical activity patterns can be identified early on, enabling prompt actions that may hinder the development of obesity and related health problems. As the child evolves and their requirements change, constant monitoring enables health plans to be updated accordingly. This flexibility is essential for preserving ideal health during different stages of development and adulthood.

**Implementation Methodology**

* **Pilot Testing:** To track the app's efficacy and get input, it will first be used in a small number of private institutions.
* **Feedback Incorporation:** The app will be improved, making it more efficient and user-friendly, based on observations from the pilot.
* **Rollout:** After the pilot, other local schools will use the app, and it will receive continual support and updates.
* **Long-Term Engagement:** The app has elements like competitions, rewards systems, and regular revisions to nutritional and exercise material that are intended to keep users engaged at high levels.

**Technology Development**

This application can be built on a scalable cloud-based platform that adheres to international standards for confidentiality and privacy. It applies machine learning techniques to constantly update and customize recommendations. The user interface is made to be simple enough for children as well as adults to make use of the application.

**Possible Limitations with the Proposed Solution**

This application must overcome some obstacles, such as low technology knowledge and access, concerns about data privacy despite having security compliances, and cultural barriers that could impede the app's effectiveness and acceptance. Additional obstacles may include the need for a substantial allocation of funds and economic limitations, especially in less developed areas in South India. These drawbacks emphasize the necessity of a comprehensive strategy that combines technology with more extensive community and educational activities to effectively tackle such issues.

**Diagrammatic illustration of Technology Solution**

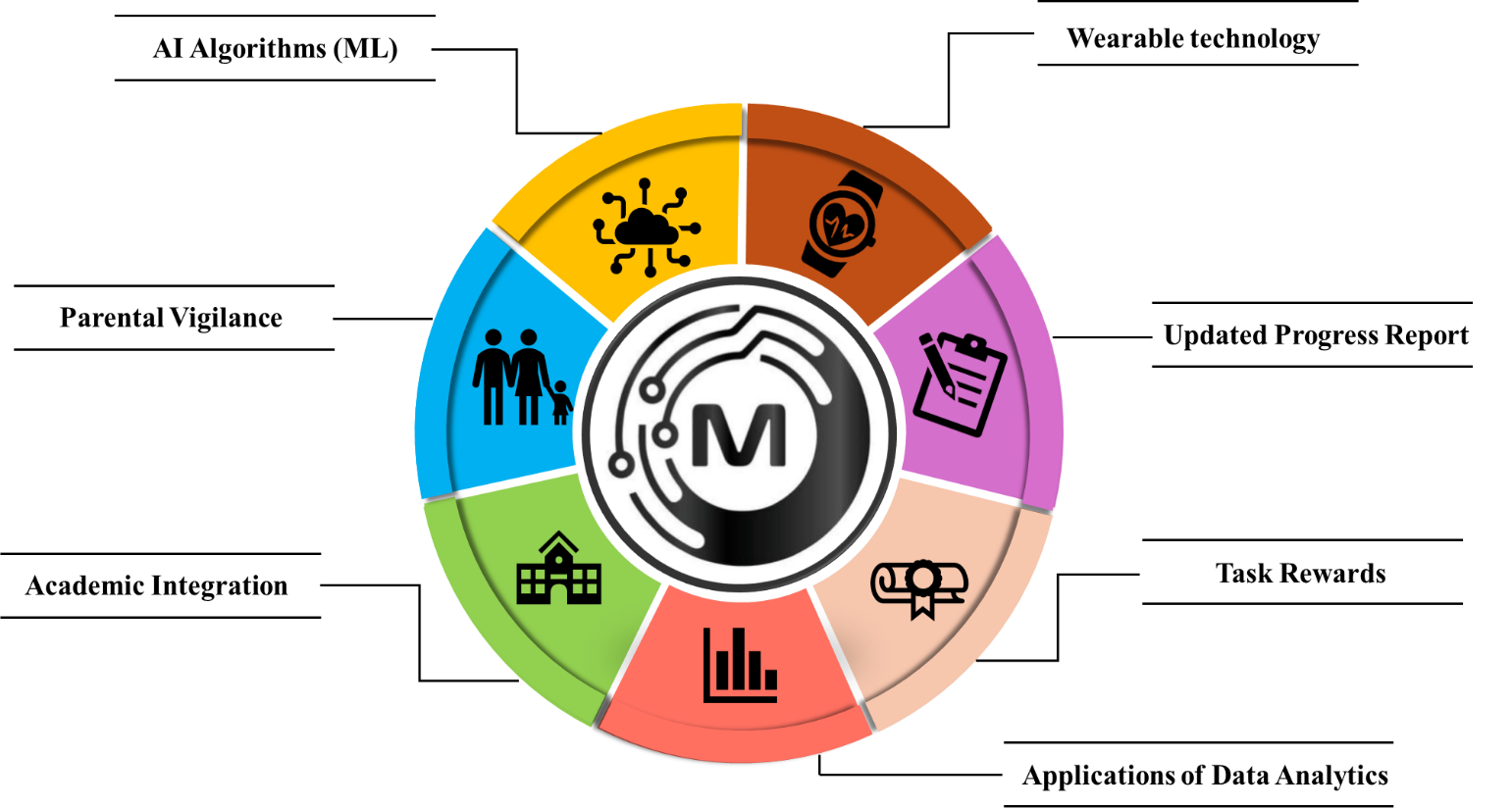


Figure 2: Illustration of proposed technology solution- mHealth Application to Combat Childhood Obesity

**Conclusion**

By creating a customized mobile health application, the project aims to address the serious and escalating problem of childhood obesity in Southern India. The nutritional and fitness guidance provided by this program can be tailored based on each user's health data and easily integrated with the private school's existing curricula. Employing artificial intelligence and data analytics, the system provides a flexible method of managing and preventing obesity by customizing its approach to meet the specific health requirements of each student. Students' lasting participation will be guaranteed, and healthier living choices can be promoted when gamification, curriculum, and parental support are combined. Through feedback-driven modifications and pilot testing, the program hopes to demonstrate its scalability and efficacy, to serve as a model for comparable interventions everywhere.

**References**

Alotaibi, M., Alnajjar, F., Cappuccio, M. L., Khalid, S., Alhmiedat, T., & Mubin, O. (2022). Efficacy of emerging technologies to manage childhood obesity. *Diabetes, Metabolic Syndrome and Obesity*, *Volume 15*, 1227–1244. <https://doi.org/10.2147/dmso.s357176>

Di Cesare, M., Sorić, M., Bovet, P., Miranda, J. J., Bhutta, Z. A., Stevens, G. A., Laxmaiah, A., Kengne, A. P., & Bentham, J. (2019b). The epidemiological burden of obesity in childhood: a worldwide epidemic requiring urgent action. *BMC Medicine*, *17*(1). <https://doi.org/10.1186/s12916-019-1449-8>

Gautam, S., & Jeong, H. (2019b). Childhood Obesity and Its Associated Factors among School Children in Udupi, Karnataka, India. *Journal of Lifestyle Medicine*, *9*(1), 27–35. <https://doi.org/10.15280/jlm.2019.9.1.27>

Luhar, S., Timæus, I. M., Jones, R. E., Cunningham, S. A., Patel, S. A., Kinra, S., Clarke, L., & Houben, R. M. G. J. (2020). Forecasting the prevalence of overweight and obesity in India to 2040. *PloS One*, *15*(2), e0229438. <https://doi.org/10.1371/journal.pone.0229438>

Nadiger, N., Anantharamu, S., Cn, P., Vidal‐Puig, A., & Mukhopadhyay, A. (2022). Unique attributes of obesity in India: A narrative review. *Obesity Medicine*, *35*, 100454. <https://doi.org/10.1016/j.obmed.2022.100454>

nutraingredients-asia.com. (2019, January 23). *India’s obesity crisis: Government-subsidised nutrition programme to tackle growing problem*. <https://www.nutraingredients-asia.com/Article/2019/01/22/India-s-obesity-crisis-Government-subsidised-nutrition-programme-to-tackle-growing-problem>

Pandey, B. G. (2022, July 29). Childhood obesity: Why are Indian children getting fatter? *BBC*. <https://www.bbc.com/news/world-asia-india-62307784>

Parthasarathi, S. K., Hebbani, A. V., & Desai, P. P. D. (2022). Vegetarian ethnic foods of South India: review on the influence of traditional knowledge. *Journal of Ethnic Foods*, *9*(1). <https://doi.org/10.1186/s42779-022-00156-1>

S, A. S., Dhanasekaran, D., Ganamurali, N., Preethi, L., & Sabarathinam, S. (2021). Junk food-induced obesity- a growing threat to youngsters during the pandemic. *Obesity Medicine*, *26*, 100364. <https://doi.org/10.1016/j.obmed.2021.100364>

Sheth, V., & Sheth, V. (2018, August 1). My Global Table: South India | Food & Nutrition | From the Magazine. *Food & Nutrition Magazine*. <https://foodandnutrition.org/from-the-magazine/my-global-table-south-india/>

Singh, S., Awasthi, S., Kapoor, V., & Mishra, P. (2023). Childhood obesity in India: A two-decade meta-analysis of prevalence and socioeconomic correlates. Clinical Epidemiology and Global Health, 23, 101390–101390. <https://doi.org/10.1016/j.cegh.2023.101390>

Viswambharan, J. K., & Abraham, R. (2021). A cross sectional study on the prevalence of overweight and obesity in affluent school children of central Kerala. *International Journal of Community Medicine and Public Health/International Journal of Community Medicine and Public Health*, *8*(9), 4284. <https://doi.org/10.18203/2394-6040.ijcmph20213187>

*World Obesity Atlas 2022 | World Obesity Federation*. (n.d.). World Obesity Federation. <https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2022>

World Health Organization: WHO. (2024, March 1). *Obesity and overweight*. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>