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Harnessing behavioral interventions to enhance micronutrient intake in pregnancy: A comprehensive review

Ilangovan Pratheesha, Aruna Subramaniam, Punitha Josephine Santhanasamy[1], Vidhya Thirunavukkarasu[2], Anand Thirunavukarasou[3]

Department of Community Health Nursing, Sri Ramachandra Faculty of Nursing, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India, [1]Department of Medical Surgical Nursing, Kasturba Gandhi Nursing College, Sri Balaji Vidyapeeth, Deemed to be University, Puducherry, India, [2]College of Applied Medical Sciences, King Faisal University, Al Hasa, Kingdom of Saudi Arabia, [3]SRIIC Lab, Central Research Facility, Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamil Nadu, India

Address for correspondence:
Dr. Aruna Subramaniam, Department of Community Health Nursing, Sri Ramachandra Institute of Higher Education and Research, Chennai - 600 116, Tamil Nadu, India.
E-mail: aruna.s@sriramachandra.edu.in

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Abstract:

Pregnancy is a pivotal moment in a woman's life, necessitating an increased focus on ensuring sufficient nutrition to promote both maternal wellbeing and fetal growth. During this period, it is crucial to emphasize the need for adequate micronutrients, including iron, calcium, and vitamin D. However, pregnant women worldwide continue to experience deficits in these essential nutrients, which increases the risk of adverse health outcomes for pregnant women and infants. Behavioral intervention presents a potentially practical approach to address this disparity by focusing on dietary modification and encouraging compliance with prescribed nutritional standards. This comprehensive review utilized a systematic literature review to collect pertinent material for the article from Scopus and Web of Science databases, ensuring scientific credibility, transparency, and comprehensiveness regarding behavioral interventions promoting increased iron, calcium, and vitamin D consumption among pregnant women. This review seeks to provide clinicians, researchers, and policymakers with information on practical techniques to enhance maternal and fetal health by improving food intake during pregnancy. Further, it will explore intervention strategies, efficacy, underlying processes, and future directions.

Keywords:

Behavioral treatments, dietary plan, food and nutrition, maternal health, micronutrients

Introduction

Pregnancy is a significant and transformative period in a woman's life, characterized by notable physiological alterations and increased dietary needs to promote the wellbeing of both the pregnant woman and the developing fetus.[1,2] The complex interaction between macronutrients and micronutrients in this timeframe highlights the significance of maintaining a well-balanced, nutrient-dense dietary regimen.[3] Iron, calcium, and vitamin D are crucial nutrients in promoting favorable outcomes for pregnant women and their infants.[4,5] It is critical to emphasize the importance of micronutrients during pregnancy.[6] Iron, an essential constituent of hemoglobin, plays a vital role in the transportation of oxygen, the metabolism of energy, and the functioning of cells.[7,8] Insufficient consumption of iron during pregnancy has the potential to result in iron deficiency anemia, which can present hazards to both pregnant women's wellbeing and fetal development.[9] Calcium is crucial for the development of bones, the functioning of muscles, and the transmission of nerve signals.[10] It significantly impacts maintaining the health of the pregnant woman's skeletal system and the mineralization of the fetus's bones. Insufficient calcium consumption during pregnancy can undermine maternal bone density and elevate the likelihood of unfavorable pregnancy outcomes.[11]

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Vitamin D, known for its involvement in the absorption of calcium, modulation of the immune system, and development of the fetal skeleton, is essential for preserving the health of pregnant women and the fetus.[12] Adverse maternal outcomes, including preeclampsia, gestational diabetes, and premature birth, as well as reduced fetal skeletal growth, have been linked to inadequate levels of vitamin D during pregnancy.[13]

Based on behavioral psychology and health promotion, behavioral interventions present a potentially practical approach to tackle eating patterns and improve nutrient consumption during pregnancy.[14,15] Behavioral therapies empower pregnant women by focusing on changeable aspects such as dietary preferences, knowledge, attitudes, and social support.[16,17] These interventions aim to enable pregnant women to make educated choices that enhance their nutritional status and contribute to the overall health of both the pregnant women and the fetus. Various interventions are available to address the different needs of pregnant women, including educational programs, dietary counseling, peer support networks, and technology-based interventions.[18]

Materials and Methods

Considering all the above, this study utilized a systematic literature review (SLR) to collect pertinent material for the article, ensuring scientific credibility, transparency, and comprehensiveness. Following a pre-established set of steps, the SLR methodically reviewed the literature, excluding irrelevant studies and enhancing the research's credibility. The objective was to analyze research findings on "behavioral interventions to enhance micronutrient intake in pregnancy." The Scopus and Web of Science databases were utilized for an extensive literature search on this topic,[19] chosen for their comprehensiveness, regular updates, and versatile data processing capabilities. The SLR process was divided into three main stages: database searches, application of specific search criteria, and selection of relevant studies for further analysis. Figure 1 depicts the techniques employed in this investigation using a prism flow diagram.

This study intends to examine the range of behavioral interventions that focus on improving the consumption of iron, calcium, and vitamin D in pregnant women. This review aims to provide clinicians, researchers, and policymakers valuable with insights into successful strategies for addressing micronutrient deficiencies during pregnancy. It achieves this by synthesizing available evidence, describing underlying mechanisms, and highlighting consequences for pregnant women and child health. This review aims to stimulate progress in maternal nutrition and enhance pregnancy outcomes worldwide by comprehensively analyzing intervention effectiveness, obstacles, and potential future directions.

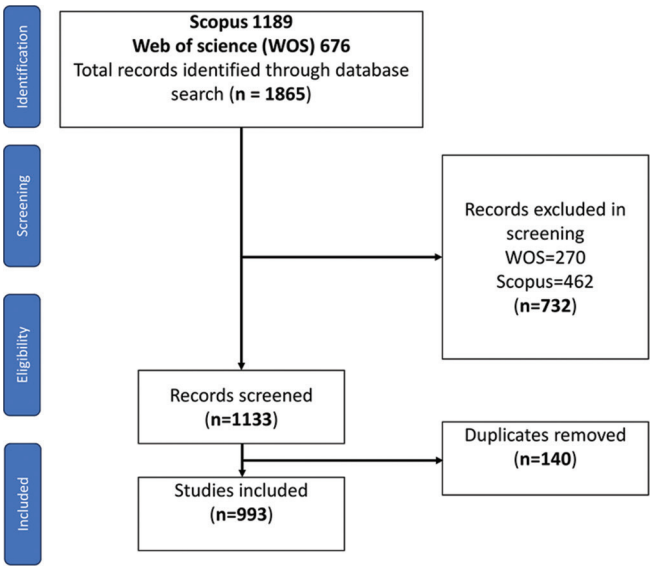

Figure 1: Prism flow diagram illustrating the systematic literature review (SLR) process for analyzing behavioral interventions to enhance micronutrient intake during pregnancy

Results

Types of behavioral interventions

Promoting good maternal nutrition during pregnancy encompasses a range of approaches, including food-based treatments, education interventions, nutrition counseling, and game-based interventions.[20] Each of these measures has distinct advantages and possibilities for empowering expectant pregnant women to make well-informed dietary decisions, optimize their nutrient consumption, and enhance the health outcomes of both pregnant women and children. Food-based interventions aim to encourage the intake of nutrient-dense meals that offer vital vitamins, minerals, and macronutrients required for the health of pregnant women and the fetus. These interventions emphasize incorporating diverse fruits, vegetables, whole grains, lean proteins, and dairy products into the maternal diet.[21] Food-based treatments empower pregnant women to make healthier dietary choices by emphasizing the nutritional worth of various food groups and offering practical help on meal planning and food preparation.[22] Furthermore, many endeavors, such as the establishment of community gardens, farmers' markets, and nutrition education programs, serve to enhance the availability of fresh, locally procured food items, thus cultivating a conducive atmosphere for the promotion of maternal nutrition.[23]

Education interventions are designed to enhance knowledge and foster awareness regarding maternal nutrition's significance in pregnancy.[24] These programs

include empirically supported information regarding dietary guidelines, micronutrient needs, food safety protocols, and effective eating behaviors. Educational materials encompass a variety of mediums, such as booklets, brochures, movies, internet resources, and interactive workshops, which are disseminated by healthcare professionals, nutritionists, and community educators.[25] Education programs empower pregnant women by providing them with precise knowledge regarding nutrition and pregnancy. This enables them to make well-informed choices regarding their food habits and encourages favorable health behaviors for themselves and their newborns.

The provision of tailored information and assistance to pregnant women through nutrition counseling is facilitated by healthcare professionals or trained counselors.[26] These individual or collective sessions evaluate eating patterns, recognize nutritional inadequacies, establish attainable objectives, and formulate customized meal strategies.[27] Nutrition counselors provide personalized suggestions tailored to the women's specific dietary requirements, tastes, cultural heritage, and overall health condition. Nutrition counseling is crucial in improving adherence to nutritional recommendations and promoting optimal outcomes for pregnant women and fetal health by addressing barriers to good eating, dispelling myths about pregnancy nutrition, and offering continuous support and responsibility.[28] An extensive summary of the different behavioral therapies designed to support optimal maternal nutrition during pregnancy is given in Figure 2. It consists of nutrition counseling, food-based therapies, education-based interventions, and game-based interventions, each having unique benefits and methods for enabling expecting moms to choose their foods wisely and maximize their intake of nutrients. Incorporating these approaches into comprehensive maternal nutrition initiatives might help alleviate maternal malnutrition's impact and enhance women's wellbeing in pregnancy globally.

Iron intake in pregnancy

Implementing behavioral interventions to increase iron consumption among pregnant women is essential in tackling the prevalent problem of iron deficiency anemia during pregnancy.[29] To enhance maternal and fetal health outcomes, these interventions utilize ideas from behavioral psychology and health promotion to facilitate dietary modifications, improve compliance with iron supplementation, and ultimately optimize overall health outcomes.[30] Table 1 thoroughly summarizes several food sources abundant in iron, including their portion sizes and estimated iron content. It includes various choices appropriate for pregnant women who want to fulfill their elevated iron needs during pregnancy. It is worth mentioning that animal-based sources such as red meat, poultry, fish, shellfish, and liver provide heme iron, which the body can absorb quite well. On the other hand, plant-based sources such as beans, lentils, tofu, nuts, seeds, and fortified cereals offer non-heme iron, typically accompanied by other necessary elements. Spinach, as well as dried fruits and nuts, contribute substantially to dietary iron consumption. Quinoa and chickpeas are rich sources of plant-based iron, making them highly flexible and essential to a balanced diet. In addition, the table showcases less familiar sources, such as blackstrap molasses and edamame, offering additional choices for pregnant women with specific dietary limitations or preferences. This resource helps to create well-rounded and varied meals that promote appropriate iron consumption

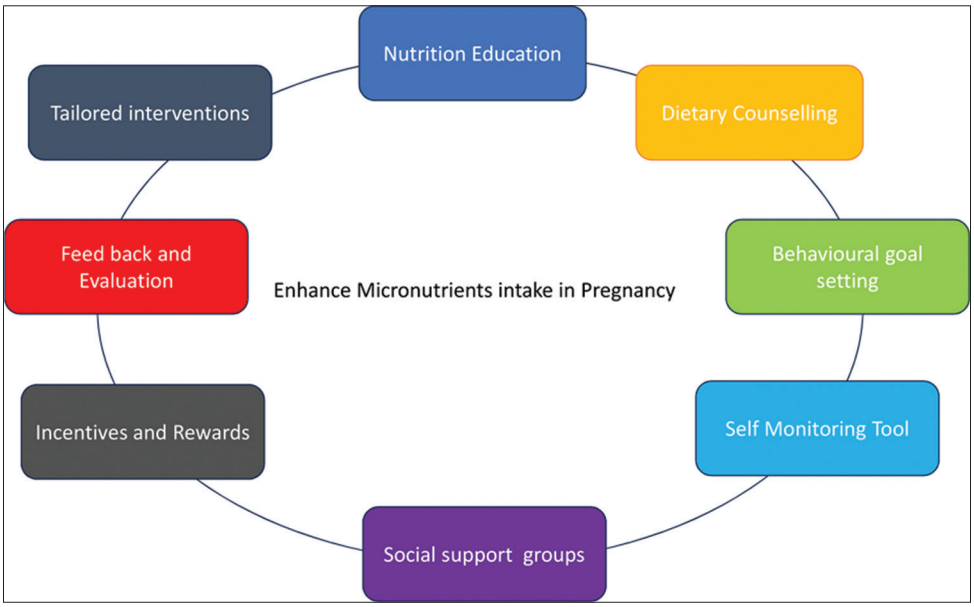

Figure 2: Overview of types of behavioral interventions for enhancing maternal nutrition during pregnancy

Table 1: The food sources of iron, their recommended serving sizes, and the approximate iron content in milligrams per specified serving size range. (Pregnant women should strive to meet the recommended daily iron intake of approximately 27 milligrams per day during pregnancy)

Food Source	Serving Size	Iron content (mg)
Red Meat (e.g., beef)	3 ounces (85 grams)	2.0-3.0
Poultry (e.g., chicken)	3 ounces (85 grams)	1.0-2.0
Fish (e.g., salmon)	3 ounces (85 grams)	0.5-1.5
Shellfish (e.g., oysters)	3 ounces (85 grams)	5.0-10.0
Liver (e.g., beef liver)	3 ounces (85 grams)	5.0-7.0
Beans and Lentils	1/2 cup cooked	2.0-3.0
Tofu and Soy Products	1/2 cup	2.0-3.0
Nuts and Seeds	1/4 cup	1.0-2.0
Fortified Cereals	1 cup	Varies
Leafy Green Vegetables	1 cup raw	1.0-2.0
Dried Fruits	1/4 cup	1.0-2.0
Quinoa	1/2 cup cooked	2
Pumpkin Seeds	1 ounce (28 grams)	2.0-3.0
Sesame Seeds	1 tablespoon	1.0-2.0
Spinach	1/2 cup cooked	2
Lentils	1/2 cup cooked	3
Chickpeas	1/2 cup cooked	2.4
Blackstrap Molasses	1 tablespoon	3.5
Fortified Pasta	1 cup cooked	Varies
Edamame	1/2 cup cooked	1.5

during pregnancy, which is crucial for the health of both the pregnant woman and the fetus. In the following section, we examine various behavioral intervention strategies designed to promote the augmentation of iron consumption among pregnant women.

Nutrition education and counseling

Pregnant women receive crucial information regarding the significance of iron during pregnancy, dietary iron sources, and methods to improve iron absorption through nutrition education and counseling sessions. Healthcare professionals, such as obstetricians, dietitians, or nutritionists, frequently facilitate these sessions, which can be administered individually or in group formats.[31] Nutrition education allows women to make informed dietary choices and encourage appropriate iron consumption by providing knowledge about iron-rich foods such as lean meats, chicken, fish, beans, lentils, leafy greens, and fortified cereals. Counseling sessions primarily center around identifying and resolving obstacles hindering dietary modification, providing pragmatic strategies for meal organization, and aiding in surmounting difficulties associated with food preferences, cultural customs, or financial limitations.

Personalized dietary planning

Tailoring iron intake recommendations to individual needs, preferences, and nutritional status is crucial to personalized dietary planning. The meal plans may incorporate particular foods that are rich in iron and pairings that are recognized to improve the absorption of iron.[32] This may involve mixing plant-based meals rich in iron with sources of vitamin C or consuming iron-fortified foods with enhancers like meat, fish, or chicken. Dietary planning interventions provide pregnant women with tailored counsel, enabling them to adopt dietary patterns that optimize iron absorption and reduce the likelihood of iron deficiency anemia.

Behavioral change techniques

Behavioral modification techniques encompass a range of tactics employed to facilitate the acceptance and sustenance of health-related behaviors, such as dietary modifications aimed at augmenting iron consumption. Behavioral psychology principles, including goal setting, self-monitoring, problem-solving, and social support, are employed in these strategies to facilitate behavior modification.[33] It is advisable to motivate pregnant women to establish precise and attainable objectives about augmenting their consumption of iron-rich foods or sticking to iron supplementation regimens. Pregnant women can monitor their nutritional intake and progress toward their goals using self-monitoring tools, such as food diaries or mobile applications. Pregnant women can overcome obstacles to dietary change by employing problem-solving strategies, while social support networks offer encouragement, accountability, and reinforcement for healthy behaviors.

Calcium intake in pregnancy

Implementing behavioral interventions targeting pregnant women to promote higher calcium intake is of utmost importance in addressing the prevalent problem of insufficient calcium consumption during pregnancy.[34] Calcium is crucial in maintaining maternal skeletal health, promoting fetal bone development, and enhancing the general wellbeing of both the pregnant women and the fetus. These interventions aim to utilize principles from behavioral psychology and health promotion to encourage dietary modifications, improve the intake of calcium-rich foods, and optimize the health outcomes of pregnant women and fetuses. Table 2 displays a wide variety of dietary sources that are abundant in calcium, which is necessary for preserving bone health and aiding in the growth of a fetus during pregnancy. The selection includes dairy and non-dairy alternatives catering to different dietary choices and constraints.

Dairy products such as yogurt, milk, and cheese are significant sources of calcium, providing easy and readily accessible choices. Moreover, fortified plant milk can be used as a substitute for individuals adhering to a vegan or lactose-free dietary regimen. Tofu, especially calcium-set tofu, is an essential plant-based calcium source that may be used in various cuisines. Collard

Table 2: The food sources of calcium, their recommended serving sizes, and the approximate iron content in milligrams per specified serving size range. (Pregnant women should aim for a daily calcium intake of around 1000–1300 milligrams)

Food Source	Serving Size	Calcium Content (mg)
Yogurt (plain, low-fat)	1 cup	300-400
Milk (skim, low-fat)	1 cup	300-400
Cheese (cheddar)	1 ounce	200-300
Fortified Plant Milk	1 cup	Varies
Tofu (calcium-set)	1/2 cup	250-750
Collard Greens	1 cup cooked	250
Kale	1 cup raw	100
Broccoli	1 cup cooked	60
Almonds	1/4 cup	90
Sesame Seeds	1 tablespoon	90
Sardines (with bones)	3 ounces	320
Canned Salmon (with bones)	3 ounces	180
White Beans	1/2 cup cooked	80
Dried Figs	1/4 cup	50
Oranges	1 medium	50
Fortified Orange Juice	1 cup	350
Fortified Cereal	1 cup	Varies
Turnip Greens	1 cup cooked	200
Spinach	1 cup cooked	240
Rhubarb	1 cup cooked	350

greens, kale, and broccoli are rich sources of calcium and other essential elements. Almonds, sesame seeds, and white beans are examples of nuts, seeds, and legumes that provide additional options for obtaining calcium.

Nutrition education and counseling

Nutrition education and counseling sessions are fundamental elements in behavioral treatments promoting calcium intake among pregnant women. The workshops offer women crucial knowledge regarding the significance of calcium during pregnancy, dietary calcium sources, and techniques to improve calcium absorption. Healthcare professionals, including obstetricians, dietitians, and nutritionists, provide evidence-based education and counseling individually or in group settings.[35] The maternal diet should prioritize incorporating calcium-rich foods, including dairy products (milk, yogurt, cheese), leafy greens (kale, collard greens), tofu, almonds, and fortified foods. Nutrition education also tackles prevalent misunderstandings regarding calcium-rich foods, such as the notion that dairy products are the sole calcium source, and offers practical advice for integrating other calcium sources into meals and snacks.

Personalized dietary planning

Customized dietary planning entails adapting calcium intake guidelines to suit individual requirements, preferences, and nutritional habits.[36] These meal plans may consist of particular foods that are high in calcium and combinations that are known to improve the absorption of calcium. This can be achieved by matching plant foods rich in calcium with sources of vitamin D or by including calcium-fortified meals in the diet. Dietary planning interventions provide pregnant women with tailored assistance, enabling them to make informed nutritional decisions that optimize calcium bioavailability and promote the wellbeing of both the pregnant women and the fetus.

Behavioral change techniques

Behavioral modification techniques encompass a range of tactics employed to facilitate the acceptance and sustenance of health-related behaviors, such as dietary modifications aimed at augmenting calcium consumption. Behavioral psychology principles, including goal setting, self-monitoring, problem-solving, and social support, are employed in these strategies to facilitate the behavior modification process.[37] It is advisable to motivate pregnant women to establish precise and attainable objectives about augmenting their consumption of calcium-rich foods or sticking to calcium supplementation regimens. Women can monitor their nutritional intake and progress toward their goals using self-monitoring tools like food diaries or mobile applications. Women can overcome obstacles to dietary change by employing problem-solving strategies, while social support networks offer encouragement, accountability, and reinforcement for healthy behaviors.

Vitamin D intake in pregnancy

Implementing behavioral interventions targeting the augmentation of vitamin D consumption among pregnant women is necessary to effectively tackle the prevalent problem of vitamin D insufficiency during pregnancy.[38] Vitamin D is an essential mineral for the wellbeing of both pregnant women and fetuses due to its significant involvement in calcium absorption, bone health, immunological function, and fetal skeletal development.[39] These interventions aim to optimize maternal and fetal health outcomes by utilizing principles of behavioral psychology and health promotion. They focus on promoting dietary modifications, increasing sun exposure, and enhancing adherence to vitamin D administration. Table 3 provides an extensive compilation of nutritional sources high in vitamin D, crucial for preserving bone health and promoting general wellness, especially during pregnancy. The establishment provides various choices that accommodate different dietary preferences and limitations. Fatty fish such as salmon and mackerel are notable providers of vitamin D, offering significant levels of this nutrient per dish. This article explores various essential behavioral intervention techniques to promote higher vitamin D consumption among pregnant women.

Table 3: The food sources of vitamin D, their recommended serving sizes, and the approximate iron content in milligrams per specified serving size range. (Pregnant women should aim for a daily intake of around 600–800 IU of Vitamin D)

Food Source	Serving Size	Vitamin D content (IU)
Fatty Fish (e.g., salmon, mackerel)	3 ounces	400-1000
Canned Tuna	3 ounces	200-300
Cod Liver Oil	1 teaspoon	400
Fortified Milk	1 cup	100-130
Fortified Orange Juice	1 cup	100
Fortified Cereal	1 cup	40-100
Fortified Yogurt	6 ounces	80
Fortified Margarine	1 tablespoon	60-80
Egg Yolks	1 large	40
Cheese	1 ounce	Oct-30
Beef Liver	3 ounces	30
Mushrooms (exposed to sunlight)	1 cup	Varies
Sardines (canned with bones)	3 ounces	170
Tofu (calcium-set, fortified with vitamin D)	1/2 cup	80
Almond Milk (fortified)	1 cup	100
Soy Milk (fortified)	1 cup	100
Pork	3 ounces	40-50
Chicken	3 ounces	40-50
Whole Grain Cereals	1 cup	Varies
Oysters	3 ounces	100

Nutrition education and counseling

Vitamin D consumption among pregnant women can be effectively addressed through behavioral treatments incorporating nutrition education and counseling sessions. These seminars aim to equip women with crucial knowledge of vitamin D's significance in pregnancy, various dietary sources of vitamin D, and practical techniques to optimize vitamin D absorption.[40] Healthcare professionals, including obstetricians, dietitians, and nutritionists, provide evidence-based education and counseling on an individual basis or in group settings. It is emphasized that the maternal diet should incorporate vitamin D-rich foods, such as fatty fish (e.g., salmon, mackerel, sardines), fortified dairy products (e.g., milk, yogurt, cheese), eggs, and fortified meals. Nutrition education also examines the significance of vitamin D supplementation in pregnancy, encompassing guidelines for dosage, timing, and potential advantages for the wellbeing of both the pregnant woman and the fetus.

Sunlight exposure promotion

Solar exposure promotion interventions aim to enhance the amount of sunshine that pregnant women are exposed to, which is the leading natural source for synthesizing vitamin D in the body. Healthcare professionals impart knowledge to women regarding moderate sun exposure's significance in facilitating vitamin D production.[41] This education considers various elements, including the time of day, duration of exposure, and the individual's skin type. Pregnant women are advised to engage in outdoor activities during the highest sunshine hours, from late morning to early afternoon, when UVB rays are most potent. Healthcare professionals offer recommendations about sun safety protocols, encompassing the utilization of sunscreen, protective attire, and eyewear to mitigate the potential hazards associated with sunburn and skin harm. These initiatives aim to enhance the vitamin D level of pregnant women and promote the health of both the pregnant women and the fetus by advocating for safe and moderate exposure to sunlight.

Behavioral change techniques

Behavioral change tactics encompass a range of strategies employed to facilitate the adoption and sustenance of health-related habits, such as dietary adjustments and lifestyle alterations aimed at augmenting vitamin D consumption. Behavioral psychology principles, including goal setting, self-monitoring, problem-solving, and social support, are employed in these strategies to facilitate the behavior modification process.[42] Pregnant women should be advised to establish precise and attainable objectives about augmenting their consumption of vitamin D-rich foods, engaging in outdoor activities to expose themselves to sunlight, or following vitamin D supplementation routines. Women can monitor their habits and measure their progress toward their goals using self-monitoring tools, such as solar exposure records or vitamin D consumption monitors. Problem-solving approaches assist women in surmounting obstacles to modifying their behavior, such as limited time availability, adverse weather conditions, or individual preferences.[43] Social support networks, such as familial relationships, friendships, or virtual communities, offer motivation, responsibility, and reinforcement for constructive actions.

Mechanisms of behavioral change

A multimodal strategy encompassing many underlying mechanisms is crucial for the success of behavioral treatments in boosting micronutrient consumption during pregnancy. These mechanisms exhibit a combinatorial effect, enabling pregnant women to make well-informed decisions regarding their dietary choices, surmount obstacles to modifying their behavior, and eventually enhance their consumption of vital micronutrients, including iron, calcium, and vitamin D. It is imperative to comprehend and utilize these mechanisms to optimize the efficacy and durability of behavioral treatments aimed at fostering favorable dietary practices in expectant pregnant women. The many behavioral strategies targeted at improving micronutrient consumption during pregnancy are depicted in Figure 3. Some methods include food-based

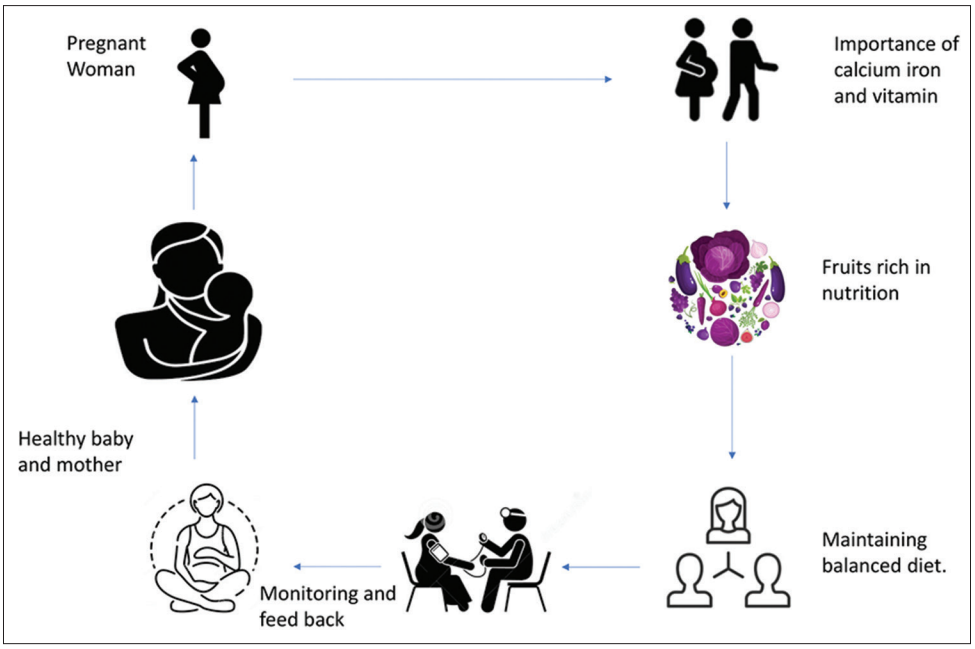

Figure 3: Overview of behavioral interventions for pregnancy micronutrient enhancement

therapies, education-based interventions, nutrition counseling, and game-based interventions. Diverse interventions present unique approaches to enable expectant moms to make knowledgeable food choices, maximize their intake of nutrients, and enhance the health of their offspring and themselves. These interventions support maternal and fetal health by addressing nutritional inadequacies and promoting nutrient-dense diets, evidence-based information, tailored counseling, and applying gamification concepts, among other strategies.

Health education

Health education is a fundamental aspect of behavioral therapies addressing maternal nutrition during pregnancy. Pregnant women are provided with evidence-based information regarding the significance of micronutrients, their impact on the health of both the pregnant women and the fetus, dietary sources, and the recommended amounts of intake through educational programs.[44] Health education establishes the basis for altering behavior. It offers precise and easily understandable information by promoting a more profound comprehension of the significance of micronutrient consumption for the wellbeing of pregnant women and fetuses.

Motivational interviewing

Motivational interviewing is a counseling strategy that prioritizes the client's perspective and seeks to evoke and enhance their inherent motivation to modify their behavior.[45] Motivational interviewing techniques are employed to boost micronutrient consumption during pregnancy to investigate women's attitudes, beliefs, and concerns about dietary modifications.[46] Medical professionals actively participate in cooperative conversations with expectant pregnant women, explicitly emphasizing understanding their motivations, values, and objectives about nutrition and pregnancy. Motivational interviewing facilitates the identification of women's motivations for change, resolution of ambivalence, and cultivation of intrinsic drive to enhance their eating patterns through establishing a supportive and non-judgmental atmosphere. This methodology places significant emphasis on empowerment, autonomy, and self-efficacy, augmenting women's preparedness to embrace and maintain healthy nutritional practices.

Goal setting

Goal setting is an essential strategy for modifying behavior, which entails the establishment of goals that are precise, measurable, attainable, relevant, and time-bound (SMART). These goals serve as a guiding framework for guiding behavior modification endeavors. Within the framework of enhancing micronutrient consumption during pregnancy, goal setting enables women to establish specific and tangible targets for their dietary patterns.[47] Potential objectives include augmenting the intake of foods abundant in iron, integrating foods abundant in calcium into regular nutritional patterns, or adhering to regimens of vitamin D supplementation. Healthcare professionals collaborate with expectant pregnant women to establish individualized objectives per their dietary requirements, preferences, and specific situations. Goal planning is crucial in facilitating progress tracking, enhancing self-efficacy, and promoting adherence to suggested

dietary behaviors by breaking down significant dietary changes into smaller, achievable steps.

Social support

Social support is crucial in promoting and maintaining healthy food habits in pregnant women. Throughout the pregnancy experience, social support networks, such as partners, family members, friends, and healthcare providers, offer encouragement, direction, and practical aid. Women can connect with others with similar experiences and concerns through peer support groups, internet forums, and community-based programs. Social support networks improve motivation, decrease loneliness, and encourage adherence to dietary recommendations by cultivating a sense of belonging, camaraderie, and accountability.[48] Furthermore, healthcare personnel can utilize social support networks to strengthen important messages, offer continuous encouragement, and commemorate accomplishments. This can effectively augment the effectiveness of behavioral interventions to improve micronutrient intake during pregnancy.

Behavior change techniques

Behavior modification techniques refer to a wide range of strategies and instruments that are employed to help individuals acquire and sustain health-related behaviors. Various tactics can be used, such as self-monitoring, problem-solving, reinforcement, modelling, and environmental restructuring, among other strategies. Within the framework of enhancing micronutrient consumption during pregnancy, behavior modification strategies are customized to target distinct obstacles and enablers of dietary modification.[49] Self-monitoring methods, such as food diaries or mobile applications, enable women to monitor their consumption of iron, calcium, and vitamin D, thereby facilitating the identification of patterns and areas that require enhancement. Women can overcome barriers to dietary change, such as time limits, economic limitations, or food aversions, by employing problem-solving skills.[50] Reinforcement tactics, such as using positive feedback and prizes, strengthen desired behaviors and foster perseverance when confronted with obstacles. Behavior change techniques improve the effectiveness and long-term viability of behavioral interventions that address micronutrient intake during pregnancy by providing women with practical skills and tools to negotiate the intricacies of dietary change.

To optimize the effectiveness of interventions promoting beneficial dietary behaviors among pregnant women, it is imperative to customize them according to individual needs, cultural settings, and socioeconomic conditions.[51] Healthcare providers can enhance the effectiveness of behavioral interventions for pregnant women and facilitate meaningful changes in their dietary habits by integrating culturally sensitive educational materials, providing personalized counseling and support, and adapting intervention strategies to align with women's cultural beliefs and practices. Furthermore, it is essential to tackle socioeconomic obstacles, such as the availability of reasonably priced, nourishing food and healthcare facilities, to advance fairness and diminish inequalities in maternal nutrition results.

Challenges and future directions

Behavioral interventions can improve maternal nutrition during pregnancy, but significant obstacles impede their effectiveness. Cultural beliefs and practices around food influence women's views on dietary guidelines and readiness to change habits. Socioeconomic disparities further complicate access to healthy food, prenatal care, and participation in programs. Inequities in healthcare resources and individual factors like health literacy and social support also affect outcomes.

A comprehensive approach is needed to address these challenges. Future research should focus on culturally sensitive interventions tailored to diverse communities. Incorporating cultural norms and practices can enhance acceptability and effectiveness. Digital health technologies, such as mobile apps and telehealth platforms, can extend the reach of interventions, overcoming barriers like geography and transportation. These technologies provide continuous education, counseling, and support, improving scalability and cost-effectiveness. Understanding the interplay of social, economic, and environmental factors on dietary patterns during pregnancy can inform more inclusive and effective interventions, promoting maternal and fetal health across diverse backgrounds.

Conclusion

Behavioral treatments are considered effective strategies for enhancing the consumption of iron, calcium, and vitamin D in pregnant women, leading to improved outcomes in pregnant women and fetal health. By focusing on dietary behaviors and identifying and resolving obstacles to behavior modification, these treatments can alleviate shortages in micronutrients and improve outcomes during pregnancy. Sustained allocation of resources towards research, innovation, and implementation endeavors is necessary to cultivate evidence-based therapies that are culturally sensitive, enabling pregnant women to effectively address their nutritional requirements and enhance the health outcomes of both pregnant women and children.

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Conflicts of interest

There are no conflicts of interest.

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