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Development of Health Behaviour Model for Overweight Prevention of Middle Age in Yun Cheng City, the People's Republic of China

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Abstract

Background and Aim: Overweight and obesity are chronic, multi-factorial metabolic diseases, with a rapidly increasing global prevalence that poses a significant threat to public health. Middle-aged populations in developing urban areas may face unique risk factors due to lifestyle and environmental transitions. The objective of this study was to develop and validate a comprehensive health behaviour model for the prevention of overweight among the middle-aged population in Yuncheng City, a mid-sized urban center in northern China.

Methodology: This study employed a sequential mixed-methods design. The target population was middle-aged adults (aged 40-59 years, of both genders, and with a BMI ≥24 kg/m² as per Chinese criteria) residing in Yuncheng City. A multi-stage sampling process was used: first, a cross-sectional survey was conducted with a calculated sample size of 402 participants, selected through stratified random sampling based on residential districts. A structured questionnaire was administered to assess dietary habits, physical activity levels, sleep patterns, and health cognitions. Descriptive statistics (means, standard deviations) were used to identify key factors associated with overweight. Subsequently, purposive sampling was used to select five experts for in-depth interviews. The integrated findings informed a draft model, which was refined through a two-round Delphi consensus process involving a panel of 19 experts. Consensus was defined as an interquartile range ≤1 and a median score ≥4 on a 5-point Likert scale. Final validation was performed by a separate panel of seven experts.

Results: The survey response rate was 97.3% (402/413). Quantitative analysis revealed that overweight status was significantly associated with three primary factors: high daily caloric intake, low physical activity, and habitual late-night activities. The Delphi process achieved strong consensus on a final model comprising 28 elements across five dimensions: 1) Healthy Dietary Behaviour (7 elements), 2) Scientific Physical Activity (6 elements), 3) Psychological and Cognitive Adjustment (4 elements), 4) Sleep and Lifestyle Modification (4 elements), and 5)

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Social-Environmental Support (7 elements). All dimensions reached the predefined consensus threshold in the second round, indicating high expert agreement.

Conclusion: This study successfully developed a consensus-based health behaviour model specifically tailored for overweight prevention in Yuncheng City's middle-aged population. The model demonstrates high content validity and expert endorsement. It provides a structured, multi-dimensional framework for designing targeted community health interventions. Future research should focus on implementing and empirically testing the model's effectiveness in fostering sustainable behaviour change and reducing overweight incidence in this and similar populations.

Keywords: Middle-aged Adults; Overweight Prevention; Healthy Behaviour; Model

Introduction

Overweight and obesity represent a significant global public health challenge, particularly among middle-aged populations, due to their strong association with chronic metabolic diseases (Unwin, 2024). The etiology of overweight is multifactorial, involving interrelated determinants such as cognitive perceptions (Karlsson et al., 2021), lifestyle patterns (Unwin, 2024), physical activity levels (Batrakoulis, 2022), psychological factors (Asharaf et al., 2024), and sleep quality (Allison et al., 2024). Although numerous studies have investigated isolated interventions—such as dietary control, exercise regimens, psychological counseling, or multi-component approaches—there remains no consensus regarding the relative importance of each factor or the most effective combined strategy for sustainable weight management in midlife (Batrakoulis, 2022).

A notable limitation in existing research is the narrow definition of physical activity, which is often restricted to structured exercise. While exercise programs—including aerobic, resistance, and combined modalities—have demonstrated efficacy in weight reduction, the optimal type, intensity, and format (e.g., jogging, resistance training with elastic bands, or square dancing) for middle-aged adults remains unclear. Moreover, non-exercise physical activities, such as active transportation, stair climbing, and household chores, are frequently overlooked despite their potential contribution to total energy expenditure. In regions like Yuncheng City, a mid-sized urban area in northern China, local lifestyle patterns, dietary customs, and environmental factors may uniquely shape these behavioral determinants, yet few studies have developed integrated models tailored to such specific sociocultural contexts. The rising prevalence of overweight in Yuncheng underscores the urgent need for effective, localized prevention strategies. Current public awareness of the health risks associated with being overweight remains limited, further amplifying the burden on local healthcare systems. This study, therefore, aims to develop and

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validate an integrated health behaviour model for overweight prevention among middle-aged adults in Yuncheng. The model incorporates five key dimensions: 1) healthy dietary behaviour; 2) scientific physical activity behaviour; 3) psychological and cognitive behaviour adjustment strategies; 4) sleep and lifestyle habits adjustment methods; and 5) social and environmental support.

By adopting a structured, multi-domain approach, this research seeks to provide a practical framework for preventing overweight, maintaining a healthy weight, and reducing obesity-related chronic disease risks. The findings of this study are anticipated to benefit public health policymakers, community health planners, and clinical practitioners in designing targeted interventions for middle-aged adults in Yuncheng and similar urban settings. Furthermore, the model may serve as a reference for future research into context-sensitive health behaviour interventions aimed at mitigating the growing burden of overweight and obesity.

Objectives

To analyze the associations between key behavioral factors (lifestyle, sleep patterns, physical activity, cognitive perceptions, and psychological factors) and overweight status among middle-aged adults (aged 40–59) in Yuncheng City.

To develop and validate a multi-dimensional health behaviour model for overweight prevention. This will be achieved by synthesizing literature, survey findings, and expert consensus (via a two-round Delphi process with predefined consensus thresholds), and subsequently evaluating its content validity and perceived feasibility via an expert validation panel.

To propose a set of implementable, multi-level intervention strategies (targeting individual, family, and community levels) derived directly from the validated model, providing a structured framework for public health initiatives and future empirical testing.

Literature review

The relevant research in this section mainly includes factors that cause overweight and research on various factors. The specific information is as follows:

Related studies on factors causing overweight

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Table 1 : Studies related to factors affecting overweight

Author (Year of publication)	Smoking	Drinking	Unhealthy diet	Sleeping	Physical activity	Household income	Educational attainment	Rural	Environmental factors	Psychological factors
Erik Hemmingsson (2021)							√	√		
Minghuan Wang (2020)	√	√				√	√	√		
Mohammed, S. H (2019)									√	
Supa Pengpid (2021)						√	√	√		
Bode, E. D (2021)						√		√		
Dalahile Zubery (2021)					√				√	
Syed Afroz Keramat (2021)		√	√		√	√		√		√
Sun, Y (2020)	√	√	√	√	√					
Kadouh (2017)			√	√		√			√	
Sartorius,B (2017)			√			√		√		
Sun, Z (2024)	√	√	√		√					
Akira Ishida (2020)			√	√	√	√	√			√
Spirou, D (2021)			√							√
Sun, Z., (2024)		√	√		√					
In total	3	5	8	3	6	7	4	6	3	3

Overweight and obesity may resemble a heterogeneous chronic disease, in which many factors interact to produce an energy imbalance and lead to weight gain. Table 1 summarizes the results of previous studies that the most frequently occurring influencing factors are: unhealthy diet, household income, physical activity, rural, drinking, psychological factors, smoking, and environmental factors. Among them, since household income, rural, and environmental factors are difficult to change, these three factors are excluded from this research. Drinking, smoking, and an unhealthy diet are classified as unhealthy factors, and educational attainment is classified as a cognitive factor. Finally, all influencing factors can be classified into 5 aspects: unhealthy lifestyle habits, factors of sleep, physical activity factors, cognition of overweight and health, and psychological factors.

Determinants of Overweight and the Rationale for an Integrated Health Behaviour Model

Overweight and obesity in middle-aged adults present a complex public health challenge shaped by the interplay of multiple behavioural and environmental factors. A robust body of evidence has established key domains influencing energy balance and weight status. These factors are not isolated; they interact within a system that varies across different populations and cultural contexts, underscoring the need for integrated and localized intervention models. This review synthesizes evidence across five primary domains to establish the foundation for a tailored health behaviour model for middle-aged adults in Yuncheng City.

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Lifestyle and Dietary Habits

Lifestyle factors, particularly diet composition, are foundational to weight management. While generic dietary advice like "eat less, move more" has proven largely ineffective (Unwin, 2024), specific nutritional strategies show promise. Evidence supports the efficacy of reducing refined carbohydrate intake and adopting low-glycaemic index (GI) diets for weight loss and metabolic improvement (Feng, 2022; Unwin, 2024). Beyond diet, other lifestyle habits compound the risk. A dose-response relationship exists between excessive alcohol consumption and the odds of general and abdominal obesity. Similarly, smoking has demonstrated a significant association with abnormal BMI, underscoring its role as a behavioural risk factor beyond its traditional health risks (Dahlawi,2024).

Sleep factors

The relationship between sleep and weight is well-established, characterized by bidirectional influences. Short sleep duration, poor sleep quality, and irregular sleep patterns are strongly linked to weight gain and higher BMI (Allison, 2024; Yang, 2024). This connection is partly mediated through behavioural pathways, such as the disruption of regular meal patterns (e.g., skipping breakfast), and physiological mechanisms, including metabolic dysregulation. Genetic studies further suggest a strong causal relationship between insomnia and higher BMI (Dashti, 2021; Yang,2024). Consequently, incorporating sleep goals into behavioral weight loss interventions is recognized as a strategy to improve outcomes (Allison, 2024).

Physical activities

Physical activity extends beyond structured exercise to include all forms of daily movement. While systematic reviews often highlight aerobic exercise as a highly effective modality for fat reduction (Batrakoulis, 2022; Morze, 2021), the evidence is not entirely uniform, with some studies indicating significant benefits from resistance training for improving body composition (Zhu et al., 2025). The most effective approach likely integrates both, combining the metabolic benefits of aerobic activity with the muscle-preserving and metabolism-boosting effects of resistance training. A critical gap in existing research is the frequent neglect of non-exercise physical activity (NEPA)—such as active transport and stair climbing—which constitutes a substantial component of total daily energy expenditure, particularly in non-athletic populations.

Cognitive factors

Cognitive function and weight status exhibit a dynamic, reciprocal relationship. Higher BMI has been associated with accelerated cognitive decline in mid-to-late life, while higher cognitive ability is linked to lower late-life BMI (Karlsson et al., 2021). Furthermore, cognitive processes such as inhibitory control and memory directly influence dietary flexibility and food intake, where impairments can lead to overeating (Higgs, 2023). The benefits of physical activity for cognitive

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function appear to be particularly pronounced among overweight individuals, suggesting that weight status may moderate this relationship (Fiscella, 2024). This underscores the need to address cognitive factors as both an outcome and a determinant in weight management.

Psychological factors

The link between psychological health and obesity is profound. Obesity is strongly correlated with a higher prevalence of stress, anxiety, and depression (Asharaf, 2024). Psychological distress can foster maladaptive coping behaviours, such as emotional eating, which is characterized by consumption of high-calorie foods in response to negative emotions and is linked to unhealthy dietary patterns (Dakanalis, 2023). While the relationship is complex and may be bidirectional, the most compelling evidence suggests that weight gain often leads to increased psychological distress (Steptoe, 2023). This highlights the necessity of integrating psychological approaches, including stress management and nutritional education for coping with negative emotions, into weight management strategies (Mohd-Sidik, 2021).

Synthesis and Rationale for the Current Study

The evidence confirms that overweight is a multifactorial condition requiring a multi-dimensional intervention approach. While the five domains reviewed are universally relevant, their specific manifestations, relative importance, and interactions are likely shaped by local cultural, environmental, and social contexts. For middle-aged adults in Yuncheng City, a "one-size-fits-all" model is unlikely to be effective. Existing research often focuses on isolated factors or generic combinations, leaving a gap for a cohesive, evidence-based model that is specifically validated for a defined population. This study directly addresses this gap by synthesizing these distinct yet interconnected domains into a single, integrated Health Behaviour Model. The proposed model, comprising 1) Healthy Dietary Behaviour, 2) Scientific Physical Activity, 3) Psychological and Cognitive Adjustment, 4) Sleep and Lifestyle Modification, and 5) Social-Environmental Support, is designed to provide a structured and locally relevant framework for developing effective overweight prevention strategies in this target population.

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Conceptual Framework

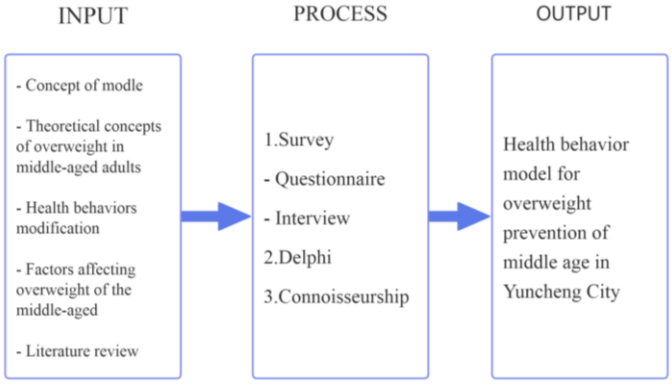


Figure 1 Conceptual Framework

Methodology

This part introduces the fundamental ideas of research design, population and sample size determination, data collection methods, research instrument preference, and data analysis techniques. The provided information is outlined as follows:

Research Design

This study employed a cross-sectional survey combined with a mixed-methods approach for model development and expert consensus (Delphi technique). The primary outcome was overweight status, defined according to Chinese guidelines as BMI ≥24 and <28 kg/m². Key predictors included dietary patterns, physical activity levels, sleep quality, psychological factors, and cognitive perceptions, with covariates encompassing age, sex, and socioeconomic status.

Population and Sample Size

The target population comprised middle-aged adults (40-59 years) residing in Yuncheng City for at least one year. Exclusion criteria included pregnancy, severe chronic illness, and inability to complete the questionnaire. Based on municipal health records, the estimated eligible population (N) was 500,000. Using Taro Yamane's formula ($n = N / [1 + N \cdot e^2]$) with a 5% margin of error ($e = 0.05$), the minimum required sample size was 397. Accounting for potential non-response, we recruited 413 participants through stratified random sampling from health centers, achieving a final sample of 402 respondents (response rate: 97.3%).

Data Collection

Data collection occurred between March and June 2024 through three phases: (1) Survey administration by trained researchers in community centers. (2) In-depth interviews with five purposefully selected experts (45-60 minutes each), audio-recorded and transcribed. (3) Two-round Delphi process with 19 experts from preventive medicine, nutrition, sports science, and

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psychology (retention rate: 100%), conducted anonymously through electronic surveys with three-week intervals.

Research instrument

The study utilized multiple instruments: (1) A structured questionnaire adapted from validated health surveys, translated through forward-backward translation procedures. It contained sections on demographics, dietary habits, physical activity, sleep quality, and psychological factors, using primarily 5-point Likert scales. (2) Semi-structured interview guides for expert interviews, developed through a literature review. (3) Delphi questionnaires with structured rating scales for model validation.

Instrument Validation

The questionnaire underwent pretesting (n=30) to establish reliability (Cronbach's α >0.7). Content validity was assessed by five health experts. For the Delphi process, we established a priori consensus thresholds: median ≥4.0 on a 5-point scale, IQR ≤1.0, and coefficient of variation (CV) <0.15.

Data Analysis

Descriptive statistics (means, standard deviations, frequencies) with 95% confidence intervals. Delphi consensus metrics: median, IQR, CV, for agreement, and stability between rounds.

Results

An analysis of the Delphi survey results from 19 experts revealed that the median and interquartile range (IQR) values for all elements of the model framework were greater than 3.50, with IQR values less than 1.50. The coefficient of variation (CV) values are all less than 0.15. This indicates that the health behaviour model for middle-aged overweight individuals in Yuncheng City is composed of the aforementioned five aspects. In summary, the model established by the researchers is accurate and reliable and can be put into practice.

Table 2 Results of the third round of the Delphi method

NO	Content	N=19		
		Mdn.	IQR	CV
1	Healthy eating behaviour methods	5.00	0	0.06-0.10
2	Scientific physical activity behaviour	4.00-5.00	0-1.00	0.08-0.11
3	Psychology and Cognitive Behaviour	5.00	0-1.00	0.05-0.11
4	Sleep and lifestyle adjustment methods	4.00-5.00	0-1.00	0.06-0.11
5	Social and environmental support	4.00-5.00	1.00	0.10-0.13

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Midlife Overweight Population Five-Dimensional Interactive Health Behaviour Model (MOP-FDIHBM)

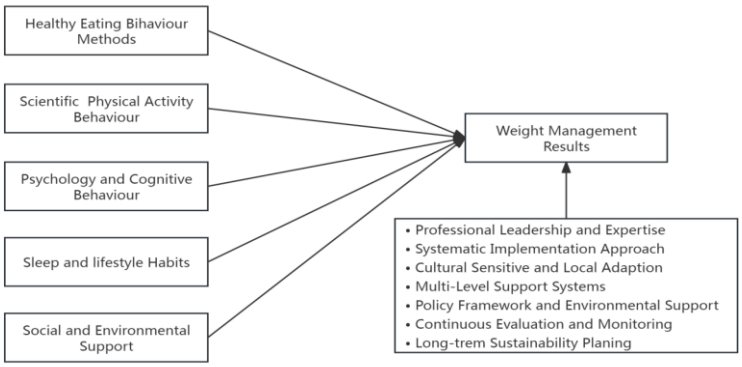


Figure 2 Health Behaviour Model for the Prevention of Overweight in Middle-aged People in Yuncheng City

Discussion

Major Findings

This study aimed to develop and validate a multidimensional health behaviour model for overweight prevention among middle-aged adults in Yuncheng City. The key findings indicate that overweight status in this demographic is influenced by a cluster of interrelated factors: high-energy dietary habits, low-intensity physical activity, late-night activities that disrupt the body's metabolic regulation, and a lack of social-environmental support. Through a series of Delphi rounds, we reached consensus on the five dimensions of the MOP-FDIHBM model, with 28 elements demonstrating strong validation from the expert panel.

Interpretation and Support From Literature

Upon analysing the study results, some were in line with existing studies, while others were not.

For elements that align with established research, the study found a strong correlation between high-energy diets and overweight status, which is consistent with findings from Mediterranean diet studies showing protective effects against obesity (Guasch-Ferré et al., 2021). However, this is expressed in the local context as a high proportion of noodles in the diet in Yuncheng. Likewise, while the study participants confirmed the benefits of moderate-intensity exercise for metabolic health, as widely reported in the literature (Batrakoulis et al., 2022), they also identified low-intensity daily activities, such as commuting habits, as significant contributors to physical activity, expanding the traditional focus on structured exercise.

For other elements, while the psychological dimension of the model identified a "knowledge-behaviour gap" that mirrors the one reported by Casazza et al. (2020), the study also

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revealed that, despite a high level of risk awareness among participants, self-efficacy for behavioural change was low, which was not observed by Casazza et al. This finding indicates that cognitive interventions might not be effective for people who have been living with established lifestyles for a long time and that psychological principles should be combined with environmental modifications.

The study's findings on sleep were largely in agreement with the available meta-analyses (Cappuccio et al., 2023), yet provided specific insights into its patterns and related factors among the middle-aged population in Yuncheng. In particular, the connection between late-night activities and metabolic disruption may be associated with the unique social and cultural dynamics of the region, including its dietary customs. Notably, a study by Mohd-Sidik et al. (2021) highlighted that lifestyle and behavioral factors—including irregular eating patterns—are significant risk factors for obesity among adults in Malaysia. Similarly, in Yuncheng, we also observed other associated elements of social lifestyle, such as staying up late, which is typical for residents of all age groups in this city.

The emphasis on social-environmental support in our model is consistent with findings from global research on neighborhood and lifestyle influences on obesity (Keramat et al., 2021) and was particularly strongly expressed by the study participants. This finding was associated with the high prevalence of cardiovascular diseases in families in this region. As this health outcome was traditionally attributed to genetic predispositions among the residents, we hypothesize that the element may also reflect shared behavioral factors. This would also mean that family-based interventions can be particularly successful in this cultural context.

Applications and Recommendations

In terms of the applications of the 28 elements of the model, the authors can see various directions for public health practice:

Individual (health care provider) level: The developed MOP-FDIHBM model can be used as a multidimensional behavioural screening checklist that health care providers can utilise when meeting with patients for a regular check-up, in addition to traditional anthropometric measurements, including body mass index. The 28 items can be used to guide individual patient counselling when addressing health-related behaviours. In this context, health care professionals can move beyond standard general recommendations to overweight prevention and improvement of health-related behaviour and focus on providing concrete individualised advice.

Community level: The social-environmental dimension of the developed model can be applied when community planners think about how to optimally use resources in this area. In this regard, the element of the availability of fitness facilities can be implemented by adding a fitness room to a new residential building. The healthy food environment element in

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supermarkets in this model can be applied in the daily operations of this entity to optimise the local product offering.

Policy level: At the policy level, the model's application can be related to the development of a complex approach to preventing overweight in this age group. In this context, the MOP-FDIHBM model can support the coordination of individual, family, and community levels of influence on health-related behaviours, which, in the long run, can help to relieve the burden on the healthcare system.

Study Strengths and Limitations

The main strengths of the study are as follows: 1) a mixed-methods study design, which we believe is rare for a similar study question, as it enabled the investigation of the proposed problem through different types of data (quantitative and qualitative) and analytical approaches; 2) the use of a series of Delphi rounds, which we think is novel in the study of health behaviour change in this population, and which allowed us to carefully work with the expert panel and track changes in the elements of the model at all stages; 3) the development of a multidimensional health behaviour model for overweight prevention with reference to a specific cultural context. The limitations include: 1) the cross-sectional survey design, which does not allow determining causal relationships; 2) the use of self-reported data, which is susceptible to recall and social desirability biases; 3) although the expert panel involved in the Delphi process represented a multidisciplinary group, we cannot exclude the possibility of missing relevant specialists, for example, a biostatistician; 4) the city-specific nature of the study, which we think limits its generalisability to other regions.

We see the following as future research directions: 1) a follow-up study with a longitudinal design to determine causal relationships between identified elements of the health behaviour model and overweight status, as well as to track the dynamics of the key components of the model over time; 2) a more in-depth examination of the physical activity element with objective measurements and a closer look at sleep, as well as the use of both subjective and objective data; 3) a validation study of the developed model in several Chinese cities of different levels and types; 4) the psychometric validation of the MOP-FDIHBM model and its testing in intervention studies.

Conclusion

This study developed and content-validated the Multidimensional Overweight Prevention Health Behaviour Model (MOP-FDIHBM), a structured framework for addressing overweight among middle-aged adults in Yuncheng City. The model integrates 28 specific elements across five core dimensions: Healthy Eating Behaviors (7 elements), Scientific Physical Activity (6 elements),

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Psychological and Cognitive Adjustment (4 elements), Sleep and Lifestyle Modification (4 elements), and Social-Environmental Support (7 elements). Expert consensus confirmed the model's relevance and local applicability, with high content validity scores supporting its conceptual foundation.

As a content-validated conceptual framework, the MOP-FDIHBM requires further psychometric testing and empirical validation through intervention studies to establish its predictive utility and effectiveness. Future research should focus on operationalizing the model elements into measurable indicators, testing its implementation in real-world settings, and evaluating long-term outcomes related to weight management and chronic disease prevention. This model represents an initial step toward developing comprehensive overweight prevention strategies tailored to the needs of middle-aged adults in northern China's urban environments.

Recommendation

Individual-Family Level: Health behaviour interventions should establish a collaborative support system. For middle-aged and elderly participants, structured self-assessment, personalized health education, and simplified self-monitoring tools (e.g., health journals) should be utilized to enhance health awareness, while fully considering cognitive and physical limitations. Family members, as key supporters, should receive systematic training to master evidence-based support strategies, including guiding healthier dietary choices while respecting traditional eating habits (e.g., wheat-based cuisine in Yuncheng), safely encouraging physical activity, and fostering a home environment conducive to regular routines. Regular family counseling sessions can strengthen this support network, ensuring intervention sustainability while addressing individualized challenges during implementation to facilitate effective transformation from cognition to behaviour.

Community-Institutional Level: A closely coordinated network-based support system should be established between the community and institutional levels. At the community level, priority should be given to building exercise facilities, safe walking paths, and healthy food environments, while maintaining intervention engagement through group activities and health workshops at community centers. Healthcare institutions and professional organizations should provide standardized technical support, including developing service protocols, training culturally sensitive professional teams, and establishing a full-chain service mechanism covering screening, intervention, and referral. A dynamic quality monitoring system is particularly crucial to ensure the professionalism and sustainability of community programs through resource allocation, ultimately forming a virtuous cycle where “communities provide settings, institutions empower expertise.”

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Policy-Environment Level: At the government policy and environmental support level, a top-down systemic framework must be constructed. Government agencies should develop comprehensive policy systems encompassing funding mechanisms, healthcare coverage, and regulatory measures, providing institutional safeguards through initiatives such as special funds and preventive intervention insurance coverage. Cross-departmental coordination mechanisms should be promoted to integrate health, social services, and community development resources, while establishing city-wide health data monitoring and evaluation systems. For environmental improvements, the focus should be on creating age-friendly public spaces and community environments, including optimized walkway safety designs, enhanced public sports facilities, and senior-friendly food labeling, supported by corresponding service standards and management regulations. Through a "policy guidance-environmental enhancement-service provision" tripartite model, a sustainable macro-level support ecosystem can be created for health behaviour interventions.

Future research

Future work should focus on implementing and empirically testing the model's effectiveness in real-world settings, with particular attention to its long-term sustainability and potential adaptation to similar populations in northern China.

References

Allison, K. C., Parnarouskis, L., Moore, M. D., & Minnick, A. M. (2024). Insomnia, short sleep, and their treatments: Review of their associations with weight. *Current Obesity Reports, 13*, 580–590. https://doi.org/10.1007/s13679-024-00570-3

Jaison K, I., Asharaf, H., Thimothy, G., George, S., Jose, J., Paily, R., Josey, J., Sajna, S. J., & Radhakrishnan, R. (2024). Psychological impact of obesity: A comprehensive analysis of health-related quality of life and weight-related symptoms. *Obesity Medicine, 45*, Article 100530. https://doi.org/10.1016/j.obmed.2023.100530

Batrakoulis, A., Jamurtas, A. Z., Metsios, G. S., Perivoliotis, K., Liguori, G., Feito, Y., Riebe, D., Thompson, W. R., Angelopoulos, T. J., Krustrup, P., Mohr, M., & Fatouros, I. G. (2022). Comparative efficacy of five exercise types on cardiometabolic health in overweight and obese adults: A systematic review and network meta-analysis of 81 randomized controlled trials. *Circulation: Cardiovascular Quality and Outcomes, 15*(6), Article e008243. https://doi.org/10.1161/CIRCOUTCOMES.121.008243

Bode, E. D., Mathias, K. C., Stewart, D. F., Moffatt, S. M., Jack, K., & Smith, D. L. (2021). Cardiovascular disease risk factors by BMI and age in United States firefighters. *Obesity, 29*(7), 1186–1194. https://doi.org/10.1002/oby.23175

Citation:
Zhou, F., & Leethong-in, P. (2026). Development of Health Behaviour Model for Overweight Prevention of Middle Age in Yun Cheng City, the People's Republic of China. Interdisciplinary Academic and Research Journal, 6(4), e293461; DOI: https://doi.org/10.60027/iarj.2026.e293461

Dahlawi, M., Aldabbagh, M., Alzubaidy, B. A., Dahlawi, S., Alotaibi, R. N., Alsharif, W. K., Alosaimi, S. B., & Hassan-Hussein, A. (2024). Association between smoking habits and body weight among general population in Saudi Arabia. *Cureus, 16*(1), Article e51590. https://doi.org/10.7759/cureus.51590

Dakanalis, A., Mentzelou, M., Papadopoulou, S. K., Papandreou, D., Spanoudaki, M., Vasios, G. K., Pavlidou, E., Mantzorou, M., & Giaginis, C. (2023). The association of emotional eating with overweight/obesity, depression, anxiety/stress, and dietary patterns: A review of the current clinical evidence. *Nutrients, 15*(5), Article 1173. https://doi.org/10.3390/nu15051173

Dashti, H. S., & Ordovás, J. M. (2021). Genetics of sleep and insights into its relationship with obesity. *Annual Review of Nutrition, 41*, 223–252. https://doi.org/10.1146/annurev-nutr-082018-124258

Feng, B. (2022). Fat-reducing effect of low-GI and low-carbohydrate diet on overweight and obesity. *China Food Safety Magazine, 21*, 134–136.

Fiscella, A. J., & Andel, R. (2024). The association between physical activity, obesity, and cognition in middle-aged and older adults. *Journal of Aging and Physical Activity, 32*(3), 397–407. https://doi.org/10.1123/japa.2023-0144

Guasch-Ferré, M., Willett, W. C., & Hu, F. B. (2021). The Mediterranean diet and health: A comprehensive review. *Journal of Internal Medicine, 290*(3), 549–566. https://doi.org/10.1111/joim.13333

Habibian, M., & Mousavi, R. A. S. (2019). The effects of regular aerobic exercise on the serum levels of plasminogen activator inhibitor-1 and adiponectin in obese girls. *The Journal of Qazvin University of Medical Sciences, 23*(5), 418–429.

Hemmingsson, E., Ekblom, Ö., Kallings, L. V., Andersson, G., Wallin, P., Söderling, J., & Ekblom-Bak, E. (2021). Prevalence and time trends of overweight, obesity, and severe obesity in 447,925 Swedish adults, 1995–2017. *Scandinavian Journal of Public Health, 49*(4), 377–383. https://doi.org/10.1177/1403494820914802

Higgs, S. (2023). Is there a role for higher cognitive processes in the development of obesity in humans? *Philosophical Transactions of the Royal Society B: Biological Sciences, 378*(1885), Article 20220208. https://doi.org/10.1098/rstb.2022.0208

Karlsson, I. K., Gatz, M., Arpawong, T. E., Dahl Aslan, A. K., & Reynolds, C. A. (2021). The dynamic association between body mass index and cognition from midlife through late-life, and the effect of sex and genetic influences. *Scientific Reports, 11*, Article 7206. https://doi.org/10.1038/s41598-021-84103-7

Keramat, S. A., Alam, K., Gow, J., & Biddle, S. J. H. (2021). Impact of disadvantaged

Citation:
Zhou, F., & Leethong-in, P. (2026). Development of Health Behaviour Model for Overweight Prevention of Middle Age in Yun Cheng City, the People's Republic of China. Interdisciplinary Academic and Research Journal, 6(4), e293461; DOI: https://doi.org/10.60027/iarj.2026.e293461

neighborhoods and lifestyle factors on adult obesity: Evidence from a 5-year cohort research in Australia. *American Journal of Health Promotion, 35*(1), 28–37. https://doi.org/10.1177/0890117120928791

Mohd-Sidik, S., Lekhraj, R., & Foo, C. N. (2021). Prevalence, associated factors, and psychological determinants of obesity among adults in Selangor, Malaysia. *International Journal of Environmental Research and Public Health, 18*(3), Article 868. https://doi.org/10.3390/ijerph18030868

Morze, J., Rücker, G., Danielewicz, A., Przybyłowicz, K., Zeng, H., Hoffmann, G., Schwingshackl, L., & Trichopoulou, A. (2021). Impact of different training modalities on anthropometric outcomes in patients with obesity: A systematic review and network meta-analysis. *Obesity Reviews, 22*(7), Article e13218. https://doi.org/10.1111/obr.13218

Steptoe, A., & Frank, P. (2023). Obesity and psychological distress. *Philosophical Transactions of the Royal Society B: Biological Sciences, 378*(1888), Article 20220225. https://doi.org/10.1098/rstb.2022.0225

Unwin, D. (2024). Reducing overweight and obesity: So how are we doing? *BMJ Nutrition, Prevention & Health*. Article e000836. https://doi.org/10.1136/bmjnph-2023-000836

Yang, W., Zhuang, Z., Huang, P., Zhang, M., Wang, K., Jiang, Y., Zhou, H., & Yu, L. (2024). Short sleep time may be the main reason for irregular breakfast to cause overweight: A cross-sectional study. *Frontiers in Nutrition, 11*, Article 1310155. https://doi.org/10.3389/fnut.2024.1310155

Zhu, Y., Li, X., Wang, Z., & Chen, H. (2025). Effects of 36-week personalized resistance training on body composition in elderly women with possible sarcopenic obesity: A randomized controlled trial. *Journal of Exercise Science & Fitness, 23*(2), 145–152.

Citation:
Zhou, F., & Leethong-in, P. (2026). Development of Health Behaviour Model for Overweight Prevention of Middle Age in Yun Cheng City, the People's Republic of China. Interdisciplinary Academic and Research Journal, 6(4), e293461; DOI: https://doi.org/10.60027/iarj.2026.e293461