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No funding was received for this study. The authors declare no conflict of interest. The study received ethical approval. All participants provided informed consent.

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Association of Lifestyle Factors with Meal Replacement Solutions in Young Adults

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ABSTRACT

Background: *Meal replacement products (MRPs) are increasingly marketed to young adults as convenient alternatives to traditional meals, yet their integration into daily routines raises questions about whether their use is linked to lifestyle determinants or primarily driven by situational and behavioral factors. Prior evidence has suggested that MRPs may support weight management and nutrient intake, but patterns of adoption in low- and middle-income settings remain poorly understood.* ***Objective:*** *This study aimed to examine the association between lifestyle characteristics and the consumption of MRPs among young adults in Gujrat, Pakistan.* ***Methods:*** *An analytical cross-sectional study was conducted between April and June 2024 using a structured 28-item survey administered to 153 participants aged 18–24 years without medical education backgrounds. Data were collected on demographics, lifestyle status, physical activity, smoking, meal-skipping behaviors, and MRP usage patterns. Associations between lifestyle variables and MRP consumption were assessed using chi-square tests at a 95% confidence level, with data analyzed in IBM SPSS Statistics version 26.* ***Results:*** *The mean age of participants was 20.9 years (SD 2.05), with 54.2% male and 64.7% urban residents. Most participants were physically active (74.5%), yet 35.3% regularly skipped breakfast. One-third (34%) reported consuming MRPs for missed meals, primarily due to cravings (51%) and convenience (15%). Ready-to-eat MRPs were more common (32.7%) than ready-to-cook (9.8%). Lifestyle indicators such as activity level and smoking status showed no significant association with MRP use ($p = 0.775$), although beliefs reflected uncertainty, with 54.9% perceiving long-term harm.* ***Conclusion:*** *The findings indicate that MRP consumption among young adults is independent of lifestyle determinants and largely driven by behavioral triggers such as cravings and irregular eating patterns. Clinically, MRPs may provide healthier alternatives to junk food but require improved consumer education regarding caloric content and long-term use. Future research should evaluate longitudinal health impacts in larger, diverse populations.*

Keywords
Meal Replacement, Lifestyle Factors, Young Adults, Dietary Behavior, Cross-Sectional Study

INTRODUCTION

Meal replacement products (MRPs) have emerged as an increasingly popular dietary option among younger populations due to their ability to provide balanced nutrients in a convenient form while reducing caloric intake. Typically offered as ready-to-drink beverages or powders requiring minimal preparation, these products combine protein, carbohydrates, fat, and micronutrients to substitute one or more daily meals, sometimes supplemented with fruits, vegetables, or snacks to meet overall nutritional needs (1). Initially used under medical supervision for weight reduction or management of chronic disease, MRPs are now widely accessible and marketed directly to consumers as lifestyle products, making their use more diverse and less clinically regulated (2,3).

The growing reliance on MRPs is partly explained by rapid shifts in lifestyle behaviors, particularly in younger adults. Studies demonstrate that busier daily schedules, urbanization, and exposure to fast-food environments have increased dependence on convenient meal solutions (4,5). For some groups, particularly those in low- and middle-income settings, access to MRPs may be uneven, influenced by socioeconomic and geographic differences in availability and affordability (6). While older adults often consume nutritional supplements to combat undernutrition or frailty (7), young adults report using MRPs primarily for weight management, convenience, or cravings, highlighting a divergence in underlying motivations (8). However, despite widespread marketing claims, their actual role in shaping eating behaviors, physical activity, and lifestyle balance remains insufficiently examined.

Recent surveys have suggested that consumers adopt MRPs for various reasons, including increased protein intake, weight loss, exercise recovery, or convenience, but the strength of these associations with broader lifestyle factors remains inconsistent across populations (9). Evidence suggests that younger adults frequently skip meals due to demanding routines and replace them with MRPs, but this behavior often coexists with consumption of fast food or energy-dense snacks, raising concerns regarding the long-term nutritional adequacy of such practices (10,11).

Moreover, physical activity patterns, socioeconomic background, and urban–rural residence appear to influence dietary substitution choices, though data on how these factors interact with MRP consumption are sparse (12,13).

The knowledge gap lies in the limited exploration of whether lifestyle determinants—such as activity levels, smoking status, dietary habits, and socioeconomic characteristics—are meaningfully associated with MRP intake among young adults in low- to middle-income countries. Most existing research originates from high-income settings, where the accessibility, awareness, and regulation of MRPs differ substantially, thereby limiting generalizability (14). Furthermore, available studies often emphasize weight loss efficacy or clinical applications, with minimal focus on everyday behavioral and lifestyle contexts. Given this background, the present study was designed to assess the association between lifestyle factors and the consumption of MRPs among young adults in Gujrat, Pakistan. The study hypothesized that lifestyle characteristics such as physical activity, occupation, smoking, and family structure may be associated with meal replacement consumption patterns. The objective was to quantify these associations using cross-sectional survey data, thereby addressing a key gap in regional evidence and contributing insights that may guide both public health strategies and consumer awareness campaigns.

MATERIAL AND METHODS

This study was designed as an analytical cross-sectional observational investigation to examine the relationship between lifestyle factors and the consumption of meal replacement products among young adults. The rationale for selecting this design was to obtain a snapshot of behaviors and associated determinants in a defined population at a single point in time, thereby allowing assessment of potential associations without the complexity of longitudinal follow-up. The research was conducted in Gujrat, Punjab, Pakistan, over a three-month period from April to June 2024, capturing data during a time when student and youth populations were accessible through academic institutions, gyms, and local community centers.

Participants were considered eligible if they were between 18 and 24 years of age, lived in Gujrat at the time of the study, and reported no severe chronic illness. Individuals with educational backgrounds in medicine or allied health sciences, including nutrition, physiotherapy, pharmacy, or radiology, were excluded to reduce bias from professional knowledge that could influence responses. Recruitment was carried out using non-probability convenient sampling, with surveyors approaching potential participants in educational institutions, fitness centers, and public spaces. After providing a full explanation of the study objectives, participants gave verbal and written informed consent prior to enrollment. To ensure voluntary participation, subjects were informed that their responses would remain anonymous and would be used exclusively for research purposes.

Data were collected using a structured 28-item questionnaire developed for this study and administered in person by trained surveyors. The tool was designed to capture demographic characteristics such as age, gender, marital status, residence (urban or rural), occupation, education level, family structure, smoking behavior, and household income. Physical lifestyle variables were assessed by asking about self-reported activity level, type and duration of daily physical activity, and smoking frequency. Dietary behaviors were addressed by documenting meal-skipping habits, frequency of meal replacement product use, type of MRP consumed (ready-to-eat or ready-to-cook), motivations for consumption, nutritional awareness, and perceived benefits or risks. Operational definitions were standardized: “meal replacement products” were defined as commercially available foods or beverages intended to substitute a whole meal, “physically active” was defined as engaging in structured or unstructured exercise at least three times per week, and “meal skipping” was defined as the omission of breakfast, lunch, or dinner on at least two occasions per week. The survey was interviewer-administered to minimize literacy barriers and to allow immediate clarification of participant queries.

To reduce bias, efforts were made to maintain consistency in administration by training survey distributors and employing standardized explanations for all questions. The exclusion of individuals with health sciences training reduced the potential for confounding due to professional knowledge. Potential confounders such as age, gender, and socioeconomic status were considered in the analysis stage by cross-tabulation and stratification. The sample size of 153 participants was based on feasibility within the defined period and resources but was deemed sufficient for chi-square analysis with categorical variables, providing more than 80% power to detect medium effect sizes at a 5% level of significance.

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize demographic and behavioral characteristics, with categorical variables expressed as frequencies and percentages, and continuous variables summarized using means and standard deviations. Chi-square tests were applied to examine associations between lifestyle factors and meal replacement product use at a 95% confidence interval. Missing data were handled through pairwise deletion to maximize the available information for each analysis. Subgroup analyses were conducted by gender and residence to explore differences in usage patterns. Statistical significance was set at $p \leq 0.05$.

Ethical approval for the study was obtained from the institutional review board of the University of Chenab, Gujrat. Written informed consent was obtained from all participants prior to data collection. To ensure confidentiality, no personally identifiable information was recorded, and completed questionnaires were securely stored and later digitized with anonymized codes. Data integrity was maintained through double entry and cross-verification by two independent researchers, and all analytical procedures were documented to allow reproducibility by other investigators.

RESULTS

The study enrolled 153 young adults with a mean age of 20.9 years (SD 2.05). Slightly more than half were men (54.2%), and the majority were single (90.8%). Most participants lived in urban areas (64.7%), and nearly three-quarters were students (72.5%). Education was relatively high, with 61.4% enrolled at the university level. A total of 15% reported current smoking, most commonly two to four cigarette packs per week, while 48.4% belonged to households with monthly incomes above PKR 100,000. Demographic characteristics were significantly associated with marital status ($p = 0.036$), urban–rural residence ($p = 0.027$), and smoking ($p = 0.008$), while gender distribution was balanced (Table 1).

In terms of lifestyle and activity, most participants described themselves as active (37.3%) or very active (21.6%), while only 14.4% reported a sedentary lifestyle. The majority (74.5%) engaged in some form of regular physical activity, with sports (29.4%) and walking (24.2%) being the most frequent. Gym use was reported by 18.3% of participants, while only a small proportion engaged in yoga or jogging. Duration of daily activity was commonly one to two hours (45.1%). All lifestyle indicators showed significant associations with physical activity variables ($p < 0.001$) (Table 2).

Meal-related behaviors revealed that breakfast was the most frequently skipped meal (35.3%), followed by lunch (20.9%), whereas dinner was least likely to be skipped (9.8%). About one-third of respondents reported skipping meals daily or two to three times per week, while 25.5% reported no skipping at all. Of those who skipped meals, 34% replaced them with MRPs, 35.3% used them occasionally, and 30.7% did not use

them. Junk food was a common substitute in the absence of MRPs, with 37.9% frequently choosing it and 41.2% doing so occasionally. The most common contexts for MRP consumption were unplanned circumstances (31.4%), cravings (21.6%), and hectic schedules (10.5%). Both types of MRPs were consumed by 41.2% of participants, with ready-to-eat products being more common (32.7%) than ready-to-cook (9.8%). Mood or cravings (51.0%) and convenience (15.0%) were the leading motivations for MRP intake, while convenience (26.1%), ingredients (17.6%), and taste (16.3%) were rated as the most important product characteristics. Nutritional preferences leaned toward comprehensive nutrient profiles, with 32.7% preferring MRPs containing all nutrient types, while protein (16.3%) and vitamins/minerals (14.4%) followed. Notably, 71.9% of respondents lacked knowledge of the recommended caloric content per meal replacement. Associations were statistically significant for almost all behavioral indicators, except the direct relationship between lifestyle and MRP intake ($p = 0.775$) (Table 3). Belief patterns further highlighted mixed perceptions of MRPs. Almost half (49.0%) believed exercise was still necessary when consuming MRPs, while 37.3% considered them useful in preventing overeating. A substantial proportion (54.9%) perceived regular MRP consumption as harmful in the long run, and only 35.3% believed MRPs could sustain overall health. Recommendation to others was nearly evenly split, with 47.7% in favor and 52.3% against. Significant associations were found regarding beliefs about exercise ($p < 0.001$) and long-term harm ($p < 0.001$), whereas beliefs about overeating prevention ($p = 0.494$), health sustainability ($p = 0.383$), and recommending MRPs ($p = 0.571$) were not statistically significant (Table 4).

Table 1. Demographic characteristics of study participants (N = 153)

Variable	Categories	n (%)	95% CI	p-value*
Age (years)	Mean ± SD	20.9 ± 2.05	–	–
Gender	Female	70 (45.8)	37.6–54.2	Reference
	Male	83 (54.2)	45.8–62.4	0.412
Marital status	Single	139 (90.8)	85.5–94.2	Reference
	Married	9 (5.9)	3.1–10.8	0.036
	Divorced/Other	5 (3.3)	1.4–7.6	–
Residence	Urban	99 (64.7)	56.8–72.0	Reference
	Rural	54 (35.3)	28.0–43.2	0.027
Occupation	Student	111 (72.5)	64.9–79.0	Reference
	Part-time + Student	14 (9.2)	5.5–15.0	0.041
	Full-time (Gov/Private)	19 (12.4)	8.1–18.6	0.032
	Other (HW/Self-employed)	9 (5.9)	3.1–10.8	–
Education	University	94 (61.4)	53.3–68.9	Reference
	College/Below	57 (37.3)	29.9–45.3	0.018
Smoking status	Yes	23 (15.0)	10.2–21.5	0.008
Household income	≥100,000 PKR	74 (48.4)	40.3–56.5	Reference
	<100,000 PKR	79 (51.6)	43.5–59.7	0.067

Table 2. Physical activity and lifestyle status

Variable	Categories	n (%)	χ^2	p-value
Lifestyle status	Sedentary	22 (14.4)	17.013	<0.001*
	Moderately active	41 (26.8)		
	Active	57 (37.3)		
	Very active	33 (21.6)		
Any physical activity	Yes	114 (74.5)	36.765	<0.001*
	No	39 (25.5)		
Activity type	Sports	45 (29.4)	110.477	<0.001*
	Walk	37 (24.2)		
	Gym	28 (18.3)		
	Other (yoga, jogging, etc.)	16 (10.5)		
	None	27 (17.6)		
Daily activity duration	<30 min	26 (17.0)	37.353	<0.001*
	30–60 min	38 (24.8)		
	1–2 h	69 (45.1)		
	>2 h	20 (13.1)		

Table 3. Meal replacement product (MRP)–related behaviors

Variable	Categories	n (%)	χ^2	p-value
Skipped meal	Breakfast	54 (35.3)	26.582	<0.001*
	Lunch	32 (20.9)		
	Dinner	15 (9.8)		
	None	52 (34.0)		
Skipping frequency	Daily	25 (16.3)	22.098	<0.001*
	2–3×/week	38 (24.8)		
	Occasionally	51 (33.3)		
	None	39 (25.5)		

Variable	Categories	n (%)	χ^2	p-value
Consume MRPs for skipped meals	Yes	52 (34.0)	0.510	0.775
	No	47 (30.7)		
	Sometimes	54 (35.3)		
Junk food use if no MRP	Yes	58 (37.9)	52.935	<0.001*
	No	12 (7.8)		
	Sometimes	63 (41.2)		
When MRPs used	Unplanned	48 (31.4)	84.961	<0.001*
	Cravings	33 (21.6)		
	Hectic schedule	16 (10.5)		
	Weekend	21 (13.7)		
	Travel/Other	16 (10.4)		
Type of MRPs used	Both	63 (41.2)	38.346	<0.001*
	Ready-to-eat (RTE)	50 (32.7)		
	Ready-to-cook (RTC)	15 (9.8)		
	None	25 (16.3)		
Main reason for MRP use	Cravings	78 (51.0)	224.464	<0.001*
	Convenience	23 (15.0)		
	Weight gain	12 (7.8)		
	Other (energy, allergies, etc.)	18 (11.8)		
Key factor in MRP	Convenience	40 (26.1)	44.804	<0.001*
	Taste	25 (16.3)		
	Ingredients	27 (17.6)		
	Calories/Nutritional value	33 (21.6)		
Preferred nutrients	All	50 (32.7)	102.235	<0.001*
	Protein	25 (16.3)		
	Vitamins/minerals	22 (14.4)		
	Carbs/Other	22 (14.4)		
Knowledge of kcal/meal	Incorrect/Don't know	110 (71.9)	344.216	<0.001*
	Correct (<450 kcal)	20 (13.0)		

Table 4. Beliefs regarding meal replacement products (MRPs)

Belief statement	Response	n (%)	χ^2	p-value
Exercise needed with MRPs	Yes	75 (49.0)	16.980	<0.001*
	No/Don't know	78 (51.0)		
MRPs prevent overeating	Yes	57 (37.3)	1.412	0.494
	No/Don't know	96 (62.7)		
MRPs harmful long-term	Yes	84 (54.9)	32.039	<0.001*
	No/Don't know	69 (45.1)		
MRPs sustain health	Yes	54 (35.3)	1.922	0.383
	No/Don't know	99 (64.7)		
Would recommend MRPs	Yes	73 (47.7)	0.320	0.571
	No	80 (52.3)		

*Statistical significance at $p \leq 0.05$.

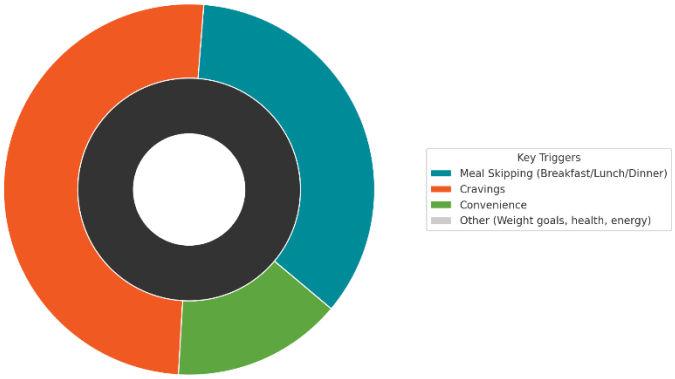

Figure 1 Behavioral Triggers Underlying MRP Consumption in Young Adults

The visualization illustrates the distribution of behavioral triggers underlying MRP consumption among young adults. Cravings accounted for the largest proportion at 51.0%, followed by meal skipping at 35.3% and convenience at 15.0%, with only a small

residual category representing weight-related or health-specific motivations. The nested cluster emphasizes that these drivers operate independently of broader lifestyle determinants, highlighting the predominance of situational and psychological cues. Clinically, this pattern indicates that interventions targeting healthier dietary behaviors in young adults must address craving control and structured meal planning, as these factors represent the most significant contributors to MRP use.

DISCUSSION

The present study demonstrated that meal replacement product (MRP) consumption among young adults was primarily driven by behavioral and situational factors such as meal skipping, cravings, and convenience, rather than by underlying lifestyle determinants such as physical activity, smoking, or family structure. Although nearly three-quarters of respondents identified as physically active and a substantial proportion engaged in sports or walking, these factors did not translate into higher or lower odds of MRP use, suggesting that the choice to consume such products is largely independent of baseline lifestyle patterns. This independence has been reported previously, where convenience and mood-related motivations outweighed structured health behaviors in shaping MRP intake (15).

Our findings that breakfast was the most commonly skipped meal align with prior work highlighting young adults' tendency to omit morning meals due to time constraints and poor dietary habits established in adolescence (16). Studies from Europe and Asia similarly report that breakfast skipping is associated with higher snack consumption and increased reliance on ready-to-eat foods, although the substitution with fortified MRPs, as observed here, can partially mitigate micronutrient deficiencies (17). However, the high prevalence of junk food use as an alternative to MRPs among our participants underscores a missed opportunity for healthier substitution, echoing research from Tehran and Guatemala that found convenience-driven food choices in youth often favored calorically dense but nutrient-poor items (18,19).

Interestingly, more than half of respondents perceived long-term MRP use as harmful, despite nearly half recommending them to peers. This ambivalence is consistent with earlier surveys in Western contexts, where MRPs were seen as effective for short-term weight control but inadequate for sustained health due to lack of variety and satiety (20). Compensatory beliefs may also be at play; individuals who substitute meals with MRPs may simultaneously engage in behaviors that undermine dietary balance, reflecting an inconsistent integration of nutrition knowledge into practice (21). Our data further revealed that females were more likely to recommend MRPs to others, while males more commonly consumed them for convenience, suggesting gendered differences in perceptions and peer influence. Such differences have been documented in Indonesia and other developing settings, where social norms and access strongly influence dietary practices (22).

The study's implications extend to public health and clinical nutrition. On one hand, MRPs could provide a useful alternative to fast foods in populations with rising meal skipping, given their standardized nutrient profiles. On the other hand, the lack of awareness about caloric content—evident in nearly three-quarters of respondents—raises concern about misuse and potential overreliance. Inadequate labeling literacy and limited education on energy balance may contribute to this knowledge gap. Clinically, while MRPs have proven utility in weight reduction programs and in supporting malnourished or older adults (23,24), their integration into the routines of healthy young adults must be considered cautiously. Behavioral reinforcement, rather than substitution, may better sustain long-term health outcomes.

The present work adds novel insights by focusing on young adults in a semi-urban Pakistani context, a population often underrepresented in global dietary studies. Whereas previous literature has primarily addressed MRPs in high-income or clinical settings, our data suggest that awareness, accessibility, and socioeconomic context are decisive in shaping their use in developing countries. Nevertheless, several limitations must be acknowledged. The modest sample size and reliance on non-probability sampling limit generalizability, and the cross-sectional design precludes causal inference. Self-reported data on diet and activity introduce recall and social desirability biases, while the absence of dietary intake validation restricts our ability to quantify substitution effects with accuracy.

Despite these constraints, the study highlights the independence of lifestyle determinants and MRP consumption, suggesting that interventions to regulate or promote MRPs should focus less on lifestyle segmentation and more on addressing behavioral motivations such as convenience, cravings, and time scarcity. Future research should build on these findings by employing larger, multi-center samples with probability-based recruitment, validating self-reports with dietary recalls or biomarkers, and examining longitudinal outcomes of MRP use on weight, metabolic health, and nutrient adequacy. Furthermore, qualitative studies exploring consumer perceptions and marketing influences may deepen understanding of the ambivalence observed in beliefs about MRPs.

CONCLUSION

This study found that among young adults in Gujrat, Pakistan, the use of meal replacement products was not significantly associated with lifestyle determinants such as physical activity, occupation, or smoking, but was instead driven by behavioral triggers including meal skipping, cravings, and convenience. These findings suggest that MRPs are adopted less as part of a structured health-oriented lifestyle and more as a compensatory response to time pressure and irregular eating habits. Clinically, this highlights the need for healthcare professionals to address the nutritional risks of frequent meal skipping and reliance on convenience foods, while also acknowledging the potential of MRPs to serve as healthier alternatives to junk food when used appropriately. For public health policy, the results underscore the importance of raising awareness about nutritional content and caloric balance, particularly since most participants lacked knowledge of ideal energy values for MRPs. Future research should expand to larger, multi-center cohorts and include longitudinal designs to evaluate the long-term health effects of MRPs, exploring whether they can be integrated into dietary strategies without compromising overall nutritional adequacy.

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