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Macro and Micronutrients Assessment of Adolescents under Orthodontic Treatment (13-18 Years)

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Abstract

Orthodontic treatment, while crucial for correcting dental irregularities, can negatively influence dietary habits and nutritional intake, particularly in adolescents[1]. This study aimed to assess the nutrient intake of adolescents undergoing orthodontic treatment and evaluate the impact of a one-month cyclic menu plan designed to address nutritional deficiencies.

A total of 40 adolescent participants aged 13–18 years were selected using a convenience sampling method. Nutritional data were collected using a three-day food recall and food frequency questionnaire. Anthropometric measurements were taken before and during orthodontic treatment, and after the intervention. Nutrient intake was analysed and compared using paired t-tests across three phases: before orthodontic treatment, during treatment, and after following the cyclic menu intervention.

Findings revealed a decrease in BMI and nutrient intake during the early phase of orthodontic treatment. Significant deficiencies were observed in energy, protein, fibre, iron, calcium, and several vitamins. However, after implementing a four-week cyclic menu, there was a notable improvement in the intake of both macro- and micronutrients, with corresponding improvements in BMI in certain age groups. The study concludes that orthodontic appliances can negatively impact dietary patterns and nutritional status. Integrating nutrition care into orthodontic management, especially during adolescence, is essential to enhance treatment outcomes and support overall health.

Keywords: Balanced diet, cyclic menu plan, dental health, malocclusion, nutritional deficiencies, orthodontic treatment

Introduction

Orthodontics[2], a specialized field of dentistry, focuses on diagnosing and correcting malocclusions. Common concerns include crowded teeth, spacing, overbites, underbites, and crossbites. Treatment methods involve the use of appliances like braces, aligners, and retainers that gradually move teeth into optimal positions for both functional and aesthetic improvements. Nutrition also plays a critical role in the success of orthodontic treatment. Patients are often advised to consume soft foods and avoid hard or sticky items to minimize discomfort and appliance damage. The physiological and emotional stress associated with treatment can affect dietary habits and nutritional intake. Dental appliances hinder chewing, which may lead to reduced food intake[3]. A well-balanced diet rich in essential nutrients is crucial during orthodontic care. Nutrients like calcium, vitamin D, phosphorus, and magnesium support healthy bones and teeth.

Furthermore, nutrient deficiencies can adversely impact treatment outcomes. For instance, insufficient calcium and vitamin D may weaken bone structure and enamel, making it harder for orthodontic tools to reposition teeth. Hence, this study aims to assess the nutritional intake of adolescents who are under orthodontic treatment and suggest intervention through cyclic menu and using various assessment tools like food frequency questionnaire, 3 days dietary recall.

Methodology

Research Methodology

The current study aims to evaluate whether adolescents undergoing orthodontic treatment are meeting the Recommended Dietary Allowances (RDA) established by the Indian Council of Medical Research. It also identifies potential nutritional deficiencies and proposes suitable interventions through a structured four-week cyclic menu plan. This plan emphasizes the inclusion of affordable, nutrient-dense foods—rich in protein, fiber, essential vitamins, and minerals—prepared in various simple and practical cooking methods. Overall, the study serves to assess the macro- and micronutrient intake of these adolescents and support their nutritional needs during orthodontic care through a balanced and accessible dietary approach.

A convenience sampling method was employed in this prospective interventional study design. The sample comprised of 40 orthodontic patients. Inclusion criteria encompassed participants of 13-18 years of both the genders under 6 months of orthodontic treatment and willingness to participate. Exclusion criteria were adolescents who are under more than 1 year of orthodontic treatment, those who have eating disorders, have clinical diagnosis of cardiovascular disease, kidney disease or malignant tumor, unwillingness to participate in the study. The entire duration of study was 3 months which includes one month of data collection, implementation, and follow-up of cyclic menu for 4 weeks, literature review analysis and descriptive writing was done for the remaining months.

Data collection was done via primary and secondary sources. To get extensive and effective insights secondary data was collected from previous works such as books and journal publications and authorised statistical databases. The primary data was collected directly from the orthodontic patients via structured questionnaire. The structured questionnaire consisted of demographic data, anthropometric assessment (height, weight, BMI), oral hygiene evaluation, dietary assessment (food frequency, 3 days dietary recall), activity level. The questionnaire comprised of data' before orthodontic treatment, during orthodontic treatment and after following 4-week intervention

strategy. Consent for participation in the study was collected from orthodontic patient and from respective legal adult.

The anthropometric assessment was done to assess the nutritional status of adolescents. The height of the participants was measured using calibrated portable stadiometer. A portable scale with a 120kg maximum capacity was used to find out the body weight of an individual, BMI was calculated.

Initial data collected in the dietary assessment are their experiences in eating before and after undergoing orthodontic treatment. Information such as consistency of food they prefer eating now, are they able to consume hard and sticky foods, their pain tolerance while eating, do they avoid certain foods that might cause pain, odour in their mouth etc. Summary of their diet history was collected as food frequency and 3 days food recall through questionnaire method.

A Food Frequency Questionnaire (FFQ) was used to evaluate the individual's usual food intake with frequency response corresponding to each food group over a specific period[4]. A 3-day dietary recall collection method was employed. Before they undergo orthodontic treatment, the participants were asked to record everything they eat and drink for three consecutive days. After few days of orthodontic treatment, the participants were again asked to record their dietary intake for three consecutive days[5]. Furthermore, nutrition education was provided to the orthodontic patients via 4-week cyclic menu plan and follow-up was done using food dairy and phone call method. The macronutrients and micronutrients were calculated using Dietcal Software.

The quantitative data that were collected was coded and analysed by the SPSS program. The frequency table, percentage analysis was formulated for demographic data, anthropometric data, oral hygiene, dietary pattern, food frequency, and activity level. Paired T-Test was used to test the hypothesis if there is any significant difference in the nutrient intake (macro and micronutrients) before and after following cyclic menu during orthodontic treatment.

Results and Discussion

Table 1: Demographic Data

Gender	N	%
13-15 Boys	09	22.5
13-15 Girls	12	30
16-18 Boys	07	17.5
16-18 Girls	12	30

The study was conducted among 40 orthodontic patients. 22.5% of the selected samples were 13-15 years boys, 30% of the samples were 13-15 years girls, 17.5% of the samples were 16-18 years boys and the remaining 30% constituted of 16-18 years girls. Higher percentage of opting orthodontic braces are in 12th grade (27.5%), then 25% of samples in 11th grade, samples from 9th and 10th grade with 20% respectively, 5% of the samples in 8th grade and least being 2.5% in 7th grade[6].

Table 2: Anthropometric Measurements of Selected Samples

	13-15 Boys						13-15 Girls					
	Height (cm)		Weight (kg)		BMI (kg/m^2)		Height (cm)		Weight (kg)		BMI (kg/m^2)	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Before	155.11	12.293	41.22	7.596	17.04	2.273	157.33	7.78	48.92	12.56	19.73	4.48
During	155.11	12.293	42.11	9.519	17.24	2.206	157.33	7.78	46.75	10.27	18.81	3.43
After	155.11	12.293	43.22	8.969	17.84	2.158	157.33	7.78	46.92	9.53	25.55	2.01
	16-18 Boys						16-18 Girls					
	Height (cm)		Weight (kg)		BMI (kg/m^2)		Height (cm)		Weight (kg)		BMI (kg/m^2)	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Before	169.71	5.469	56.00	9.747	19.51	3.893	155.83	8.089	47.92	11.524	19.650	4.3408
During	169.71	5.469	57.43	12.354	20.03	4.779	155.83	8.089	47.42	11.920	18.4583	2.78681
After	169.71	5.469	58.00	12.633	21.37	4.263	155.83	8.089	47.958	11.5453	22.050	1.03

Before Treatment: 13–15 years boys had a mean height of 155.11 ± 12.93 cm, weight 41.22 ± 7.59 kg, and BMI 17.04 ± 2.27 kg/m². Girls measured 157.33 ± 7.78 cm, 48.92 ± 12.56 kg, and BMI 19.73 ± 4.48 kg/m².16–18 years boys recorded 169.71 ± 5.49 cm, 56 ± 9.74 kg, and BMI 19.51 ± 3.89 kg/m², while girls had 155.83 ± 8.09 cm, 47.92 ± 11.52 kg, and BMI 19.65 ± 4.34 kg/m².

During Treatment: Slight increases in weight and BMI were observed. For example, BMI rose to 17.24 ± 2.20 kg/m² in boys and 18.81 ± 3.43 kg/m² in girls aged 13–15.

After One-Month Intervention: Further improvement was noted post-intervention with BMI increasing to 17.84 ± 2.15 kg/m² in 13–15-year-old boys and a notable rise to 25.55 ± 2.01 kg/m² in girls. Among 16–18-year-olds, boys' BMI increased to 21.37 ± 4.26 kg/m² and girls' to 22.05 ± 1.03 kg/m². Overall, the one-month cyclic menu plan led to positive trends in BMI across all groups, with the most significant improvement observed in 13–15-year-old girls.

Table 3: BMI Status

BMI Status		Before		During		After	
		N	%	N	%	N	%
N=40	Underweight	8	20.0	12	30.0	7	17.5
	Normal	28	70.0	26	65.0	30	75.0
	Overweight	4	10.0	2	5.0	3	7.5

BMI analysis revealed that prior to orthodontic treatment, 20% of adolescents were underweight, 70% had normal BMI, and 10% were overweight. During treatment, the percentage of underweight individuals increased to 30%, while 65% remained in the normal range and 5% were overweight. Following one month of the cyclic menu intervention, underweight prevalence decreased to 17.5%, normal BMI increased to 75%, and overweight cases rose slightly to 7.5%[7].

Table 4: Analysis OB BMI

	Pairs	Paired Differences		P Value
		Mean	SD	
13-15 Boys	BMI Before - BMI During	-0.20	1.406	0.684
	BMI During - BMI After	-0.60	0.535	0.010*
13-15 Girls	BMI Before - BMI During	0.93	1.537	0.061
	BMI During - BMI After	-6.74	18.815	0.240
16-18 Boys	BMI Before - BMI During	-0.51	0.997	0.221
	BMI During - BMI After	-0.25	0.362	0.151
16-18 Girls	BMI Before - BMI During	1.19	3.850	0.307
	BMI During - BMI After	-3.59	15.278	0.433

Through this study, it was observed that there were no significant changes in BMI between the before treatment and during treatment phases across the sample groups. However, a statistically significant increase in BMI was found among 13–15-year-old boys after the one-month dietary intervention (*p* 0.010), while other groups did not show significant changes[8].

Table 5: Comparison of Mean 3 Days Dietary Recall – Before Orthodontic Treatment Vs during Orthodontic Treatment (13-15 Years)

Nutrients	13-15 Boys				13-15 Girls			
	Before	During	RDA	P Value	Before	During	RDA	P Value
Energy (Kcal)	983.18	905.91	2860	0.130	1009.15	891.34	2400	0.184
Protein (g)	30.33	25.82	80	0.253	26.33	22.99	60	0.208
Fats (g)	36.63	35.39	79	0.828	40.11	38.65	66	0.757
Fibre (g)	12.94	10.70	25-35	0.152	13.08	12.25	25-35	0.581
Carbohydrate (g)	129.99	114.08	429	0.170	131.83	110.30	360	0.040*
Iron (mg/day)	4.88	3.95	22	0.149	4.37	4.00	30	0.487
Calcium (mg/day)	391.07	270.34	1000	0.017*	311.41	279.86	1000	0.462
Magnesium (mg/day)	183.12	106.58	345	0.119	138.88	128.08	340	0.564
Manganese (mg/day)	2.01	1.58	4	0.163	1.99	1.71	4	0.299
Phosphorous (mg/day)	568.97	460.72	600	0.058	484.87	449.36	600	0.336
Vitamin-A (mcg/day)	151.10	129.39	930	0.447	125.50	113.12	890	0.525
Vitamin-C (mg/day)	27.17	18.51	70	0.266	30.62	31.91	65	0.788
Vitamin-B_1 (mg/day)	0.46	0.50	1.9	0.805	0.43	1.36	1.6	0.374
Vitamin-B_2 (mg/day)	0.41	0.30	2.7	0.045*	0.35	0.33	2.2	0.711
Vitamin-B_3 (mg/day)	4.04	4.08	19	0.957	4.43	3.83	16	0.295
Vitamin-B_{12} (mcg/day)	0.016	0.01	2.2	0.960	0.007	0.03	2.2	0.884

In 13–15-year-old boys, there were no significant changes in most nutrients between the before treatment and during-treatment phases. However, calcium (*p* 0.017) and vitamin B2 (*p* 0.045) levels showed a significant difference. In 13–15-year-old girls, most nutrient levels remained unchanged during treatment, except for carbohydrates, which showed a significant difference (*p* 0.040).

Table 6: Comparison of Mean 3 Days Dietary Recall – Before Orthodontic Treatment Vs during Orthodontic Treatment (16-18 Years)

Nutrients	16-18 Boys				16-18 Girls			
	Before	During	RDA	P Value	Before	During	RDA	P Value
Energy (Kcal)	1236.88	882.07	3320	0.012*	1056.26	856.83	2500	<0.001*
Protein(g)	37.64	25.63	90	0.012*	29.88	23.45	60	<0.001*
Fats (g)	40.11	31.91	92	0.043*	40.64	32.39	69	0.006*
Fibre (g)	16.10	9.82	25-35	0.001*	12.45	11.11	25-35	0.254
Carbohydrate (g)	208.28	120.49	498	0.114	141.04	114.31	375	0.005*
Iron (mg/day)	5.61	3.61	26	0.004*	5.01	4.02	32	0.047*
Calcium (mg/day)	380.99	318.07	1050	0.173	408.78	341.11	1050	0.025*
Magnesium (mg/day)	180.18	111.52	440	0.002*	143.21	128.48	380	0.233
Manganese (mg/day)	2.78	1.46	4	0.008*	1.98	1.84	4	0.564
Phosphorous (mg/day)	718.21	498.37	600	0.006*	584.99	508.57	600	0.037*
Vitamin-A (mcg/day)	164.96	135.92	1000	0.179	149.22	137.23	860	0.352
Vitamin-C (mg/day)	23.55	15.78	85	0.070*	21.05	18.93	70	0.502
Vitamin-B_1 (mg/day)	0.58	0.40	2.2	0.029*	0.47	0.39	1.7	0.104
Vitamin-B_2 (mg/day)	0.45	0.36	3.1	0.167	0.49	0.38	2.3	0.048*
Vitamin-B_3 (mg/day)	6.51	3.95	22	0.004*	4.68	3.58	17	0.030*
Vitamin-B_{12} (mcg/day)	0.153	0.01	2.2	0.649	0.052	0.02	2.2	0.427

Through this study the comparison of nutrient intake in 16–18-year-old boys before and during orthodontic treatment were done. No significant differences were found in carbohydrates, calcium, vitamin A, vitamin C, vitamin B2, and vitamin B12. However, significant changes were observed in energy (*p* 0.012), protein (*p* 0.012), fats (*p* 0.043), fibre (*p* 0.001), iron (*p* 0.004), magnesium (*p* 0.002), phosphorous (*p* 0.006), vitamin B1 (*p* 0.029), and vitamin B3 (*p* 0.004). In 16–18-year-old girls, fibre, magnesium, manganese, vitamin A, vitamin B1, and vitamin B12 showed no significant change. Significant differences were found in energy (*p* 0.001), protein (*p* 0.001), fats (*p* 0.001), carbohydrates (*p* 0.005), iron (*p* 0.047), calcium (*p* 0.025), phosphorous (*p* 0.037), vitamin C (*p* 0.001), vitamin B2 (*p* 0.048), and vitamin B3 (*p* 0.030)[9].

Table 7: Comparison of Mean 3 Days Dietary Recall – During Orthodontic Treatment Vs after One Month Intervention (13-15 Years)

Nutrients	13-15 Boys				13-15 Girls			
	During	After	RDA	P Value	During	After	RDA	P Value
Energy (Kcal)	905.91	2199.56	2860	<0.001*	891.34	2109.89	2400	<0.001*
Protein (g)	25.82	50.50	80	<0.001*	22.99	41.12	60	<0.001*
Fats (g)	35.39	60.29	79	<0.001*	38.65	47.00	66	0.014*
Fibre (g)	10.70	30.60	25-35	<0.001*	12.25	29.04	25-35	<0.001*
Carbohydrate (g)	114.08	400.60	429	<0.001*	110.30	292.73	360	<0.001*
Iron (mg/day)	3.95	17.57	22	<0.001*	4.00	24.79	30	<0.001*
Calcium (mg/day)	270.34	756.41	1000	<0.001*	279.86	833.47	1000	<0.001*
Magnesium(mg/day)	106.58	245.13	345	<0.001*	128.08	282.79	340	<0.001*
Manganese(mg/day)	1.58	2.34	4	0.032*	1.71	2.61	4	0.043*
Phosphorous(mg/day)	460.72	459.70	600	0.976	449.36	468.29	600	0.778
Vitamin-A(mcg/day)	129.39	229.31	930	0.064	113.12	159.57	890	0.291
Vitamin-C(mg/day)	18.51	28.12	70	0.046*	31.91	52.51	65	0.004*
Vitamin-B_1 (mg/day)	0.50	1.16	1.9	0.009*	1.36	0.45	1.6	0.339
Vitamin-B_2(mg/day)	0.30	0.74	2.7	0.035*	0.33	0.56	2.2	0.279
Vitamin-B_3(mg/day)	4.08	4.19	19	0.688	3.83	4.03	16	0.268
Vitamin-B_{12}(mcg/day)	0.01	0.26	2.2	0.008*	0.03	0.62	2.2	0.044*

The above table shows the comparison of nutrient intake in 16–18-year-old boys before and after one month of dietary intervention. Significant improvements were observed in energy, protein, fats, fibre, carbohydrates, iron, calcium, magnesium (all $p < 0.001$), manganese (p 0.032), vitamin C (p 0.046), vitamin B1 (p 0.009), vitamin B2 (p 0.035), and vitamin B12 (p 0.008). No significant changes were found in phosphorus, vitamin A, or vitamin B3.

Similarly, in 16–18-year-old girls, significant differences were seen in energy ($p < 0.001$), protein ($p< 0.001$), fats (p 0.014), fibre ($p < 0.001$), carbohydrates ($p < 0.001$), iron ($p < 0.001$), calcium ($p < 0.001$), magnesium ($p < 0.001$), manganese (p 0.043), vitamin C (p 0.004), and vitamin B12 (p 0.044). No significant changes were observed in phosphorus, vitamin A, vitamin B1, B2, or B3.

Table 8: Comparison of Mean 3 Days Dietary Recall – During Orthodontic Treatment Vs after One Month Intervention (16-18 Years)

Nutrients	16-18 Boys				16-18 Girls			
	During	After	RDA	P Value	Before	After	RDA	P Value
Energy (Kcal)	882.07	3075.08	3320	<0.001*	1056.26	2248.99	2500	<0.001*
Protein (g)	25.63	56.35	90	<0.001*	29.88	50.03	60	<0.001*

Fats (g)	31.91	85.97	92	<0.001*	40.64	55.21	69	<0.001*
Fibre (g)	9.82	33.58	25-35	<0.001*	12.45	29.65	25-35	<0.001*
Carbohydrate (g)	120.49	972.82	498	0.161	141.04	329.19	375	<0.001*
Iron (mg/day)	3.61	19.70	26	0.001*	5.01	9.05	32	0.007*
Calcium (mg/day)	318.07	670.93	1050	0.002*	408.78	391.11	1050	0.377
Magnesium (mg/day)	111.52	132.65	440	0.231	143.21	188.48	380	0.015*
Manganese (mg/day)	1.46	1.83	4	0.088	1.98	2.17	4	0.172
Phosphorous(mg/day)	498.37	455.66	600	0.037*	584.99	522.14	600	0.222
Vitamin-A (mcg/day)	135.92	207.35	1000	0.039*	149.22	161.31	860	0.210
Vitamin-C (mg/day)	15.78	54.19	85	0.0001*	21.05	42.28	70	<0.001*
Vitamin-B_1 (mg/day)	0.40	0.56	2.2	0.314	0.47	0.56	1.7	0.104
Vitamin-B_2 (mg/day)	0.36	1.08	3.1	0.047*	0.49	0.72	2.3	0.039*
Vitamin-B_3 (mg/day)	3.95	4.82	22	0.138	4.68	3.83	17	0.084
Vitamin-B_{12} (mcg/day)	0.01	0.78	2.2	0.245	0.052	0.38	2.2	0.013*

The above table depicts comparison of nutrient intake in 16–18-year-old boys before and after the one-month dietary intervention. Significant improvements were found in energy, protein (both $p < 0.001$), fats (p 0.014), fibre ($p < 0.001$), iron ($p < 0.001$), calcium (p 0.002), vitamin A (p 0.039), and vitamin B2 (p 0.000), phosphorous (p 0.037), vitamin C (p 0.001). No significant differences were observed in carbohydrates, magnesium, manganese, vitamin B1, or vitamin B3.

In 16–18-year-old girls, significant increases were noted in energy, protein, fats, fibre, and carbohydrates (all $p < 0.001$), along with iron (p 0.007), magnesium (p 0.015), vitamin C ($p < 0.001$), vitamin B2 (p 0.039), and vitamin B12 (p 0.013). No significant changes were found in calcium, manganese, phosphorus, vitamin A, vitamin B1 or vitamin B3

The present study is in concordance with an extensive study conducted by Shirazi et al., (2011) unequivocally revealed notable differences in dietary patterns between the orthodontic group and the control group. Specifically, individuals in the orthodontic group exhibited a markedly higher consumption of fat and a lower intake of fibre compared to the control group. Additionally, the orthodontic group demonstrated lower intakes of beta-carotene and chromium, while showing significantly higher consumption of saturated, monounsaturated, and polyunsaturated fats, as well as cholesterol[10].

Similarly in the study conducted by Merve Ozdemir et al., (2021) evaluated the changes in food consumption in adolescents (12-18 years) during orthodontic treatment. When the food consumption records of the teenagers were compared at the first week, first month, and third month of the active orthodontic treatment, as well as before the orthodontic therapy, there was no discernible variation in the intake of total calories, protein, and carbohydrates. But overall fat consumption reduced after the first week of treatment and markedly increased over the course of the course of the treatment. Patient's intake of fibre, vitamin C, and vitamin E significantly dropped while receiving orthodontic treatment. Hence, the present study corroborates with the previous study[11].

The food frequency questionnaire revealed that participants consumed cereals, millets, pulses, and dairy products on daily basis. A higher percentage reported

weekly consumption of green leafy vegetables, roots and tubers, and other vegetables. Increased intake of fresh juices, sweets, fats, and oils was also observed. However, most participants had a lower intake of nuts, carbonated beverages, condiments, pork, and beef. Poultry and seafood were commonly consumed twice a week by a larger portion of the group[12].

Among the 40 participants, 45% frequently skipped meals, while only 7.5% never did. The main reason for skipping meals was lack of time (52.5%), followed by difficulty chewing due to discomfort from braces (22.5%). Breakfast was commonly skipped meal (75%), followed by dinner (15%) and lunch (10%)[13].

Monthly orthodontic adjustments often led to dental pain and stress, influencing food preferences[14]. Most participants (37.5%) preferred soft solid foods, 32.5% opted for liquids, and only 7.5% managed normal foods. Many avoided sticky or hard foods, favouring shredded or easy-to-chew options. Most participants reported difficulty chewing hard foods such as biscuits, whole chapatis, green leafy vegetables, nuts, chips, Indian savouries, hard candies, pizza, burgers, and solid chocolates. Around 23 participants preferred rice in porridge form and fruits as fresh juices or milkshakes. They were more comfortable consuming soft foods like plain chocolates, ice creams, cakes, Indian sweets, shredded chicken, tea/coffee, chapati soaked in curry, dairy products, noodles, and cooked vegetables[15].

Many found it difficult to bite and chew certain foods, with some experiencing pain afterward[16]. Green leafy vegetables and heme-rich foods were commonly avoided due to the risk of getting stuck in braces. A few also expressed concerns over damaging braces or staining their teeth with items like tea, coffee, or chocolates.

Conclusion

Nutrition care should be an integral part of orthodontic care. The study comprises collecting nutritional history, assessing diet, and teaching the patient regarding food items that are crucial for dental health, encouraging the patient to eat balanced meal with inclusion of all food groups. Through the study it was evident that most of the orthodontic patients have reduction in the body mass index levels during the initial phase of orthodontic treatment. There were immense changes in the dietary intake which lacked in macro and micronutrients. Hence, consuming balanced diet is important especially during the adolescent phase where they experience transition in physical, mental, and social well-being[17].

Malocclusion affects both oral health and psychological well-being, making early detection and timely orthodontic treatment essential, especially during adolescence. Additionally, malocclusion has a negative impact on communication, swallowing, and mastication[18]. Adolescence represents a time where they frequently experience cravings, an increased metabolic need, social acceptance, peer pressure, and a desire to explore diverse foods, all of which have a bearing on what they choose to consume[19]. A proper nutritional support during orthodontic treatment plays a key role in improving treatment outcomes. Promoting healthy eating habits and oral hygiene is therefore vital for their overall well-being[20].

The study compared nutrient intake over three days during different stages of orthodontic treatment. Before and during treatment, significant deficiencies in macro and micronutrients were observed, with reduced intake of energy, protein, carbohydrates, and fibre, as well as insufficient levels of iron, calcium, and phosphorus. After following a one-month cyclic menu plan during orthodontic treatment, significant improvements in

nutrient intake were observed. There was an increased food intake, preferred balanced meals, and higher energy levels, with noticeable improvements in macro and micronutrient levels. In conclusion, all existing evidence points to the fact that orthodontic appliances alter the patient's diet in generally unfavourable ways that can reduce the nutritional quality of the diet in regard to both macronutrients and micronutrients during the adolescent phase.

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