



Centric Observational Study: Effectiveness of Centrum Multivitamin on Quality of Life and Immune Health Parameters in Indian Population

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Received: 9 September 2025

Revised: 29 September 2025

Accepted: 10 October 2025

ABSTRACT

Health-related quality of life (HRQoL) reflects overall health parameters. Micronutrients are essential for maintaining optimal body functions, and deficiencies can impair daily activities and increase the risk of disease, thus impacting quality of life (QoL). This observational study evaluated the impact of multivitamin supplementation on QoL and immunity parameters after Centrum multivitamin supplementation among 614 adults aged 18 years and older. Patients who were scheduled to return for a follow-up consultation after at least 3 months and within 4 months, were able to read, comprehend and answer questions in online questionnaires, and were able and willing to provide consent to participate in this study, were enrolled. Centrum Men, Centrum Women, or Centrum Adults 50+ tablets were taken once-daily for at least 3 months. QoL parameters were evaluated using the EuroQoL 5-dimension 5-level (EQ-5D-5L) scale, while immune health parameters were assessed using a single-item immune fitness, reduced immune fitness rating, and number of sick days. On average, patients reported improved QoL demonstrated by higher EQ-5D-5L utility score after consumption of Centrum multivitamin ($p < 0.001$ for each group). A higher proportion of patients reported having no problems across all dimensions of EQ-5D parameters. A significant number of patients reported improved immune fitness rating, and a lower proportion of patients reported having reduced immune fitness after consumption of Centrum multivitamin supplements, with a ~50% decrease in the mean number of reported sick days in the past month across all three variants. Centrum multivitamin significantly improves QoL parameters and immune health among the Indian population.

Keywords: Micronutrients, adults, quality-of-life, supplementation, immunity.

INTRODUCTION

Adequate nutrition is an important aspect of a healthy lifestyle for all individuals and is fundamental to the healthy functioning of cells, tissues, organs, and all body systems. The supply of macronutrients and micronutrients (e.g., vitamins and trace elements) supports essential molecular, cellular and physiological processes [1,2]. Micronutrient deficiencies occur due to insufficient intake, malabsorption, increased dietary requirements, greater metabolic losses, and age-related physiological changes [3]. Micronutrient deficiencies are common in India, and the prevalence rates are summarized in Table 1 [4,5].

Table 1. Summary of vitamin deficiencies in adults in India

Micronutrient deficiency	Prevalence among adults in India
Vitamin B2	50%
Vitamin B6	46%
Vitamin B12 (active form)	46%
Vitamin B12 (total)	37%
Vitamin D	97.2%
Vitamin D (in adults aged >60 years)	99.2%

Data source [4] and [5].

Due to the growing recognition of the importance of adequate nutrition intake in recent years, dietary supplements such as multivitamins are frequently consumed by individuals to supplement nutrition or in an effort to improve health and performance [6]. A study revealed that 74% of healthcare practitioners (HCPs) in India are positively inclined to prescribe a multivitamin



supplement [7]. However, consumption of multivitamins without a physician's prescription is common in India. Sekhri, et al., reported that 30.3% of individuals consuming multivitamins were self-medicated or consuming multivitamin supplements on the advice of family or friends [8]. Chaudhary, et al., reported that 64% of participants consumed multivitamins on physicians' advice, followed by self-administration (27%), family (5%) and internet (4%) as other sources of information [9]. The reasons for self-medication included maintenance of general health, to improve appetite, and to reduce weakness or fatigue [8].

It is being increasingly recognized that maintaining or improving quality of life (QoL) is an indication of health. Nutrition plays an important role in supporting overall immune health parameters [10,11]. Studying QoL is important for evaluating response to treatment, identifying red flags in acute symptoms, understanding domains that are difficult to observe, identifying unmet needs of patients, and improving communication [12,13]. Micronutrient supplementation has been widely investigated for its impact on QoL parameters. Since nutrition and micronutrients are critical in the maintenance of overall health and well-being, it may follow that micronutrient supplementation can improve QoL. Subclinical deficiencies in micronutrients may manifest as altered psychological status, and studies have reported that micronutrient supplementation is associated with reduced anxiety, personal strain, confusion, and depressed/dejected mood [14,15].

The micronutrients in Centrum Women, Men and Adults 50+ formulations have been shown to support energy levels, immune function, nervous system and stress levels, enhance metabolism, promote healthy musculoskeletal function, and contribute to skin health and overall cardiovascular health [16-18]. Furthermore, COcoa Supplement and Multivitamin Outcomes Study (COSMOS) clinical trials have shown that daily use of Centrum Silver slows cognitive aging in older adults compared with placebo, with improvement in memory tests [19,20].

Adequate vitamin C intake is needed for reducing the risk of chronic diseases, while vitamin D plays a role in preventing autoimmune diseases [21,22]. Zinc supplementation overcomes impaired immune cell development and boosts immunomodulatory and anti-inflammatory action [23]. Studies have demonstrated that supplementation of micronutrients among older adults (66–86 years old) for 1 year leads to increased T-lymphocyte and Natural Killer (NK) cell count, and NK cell activity. In another study, micronutrient supplementation among adults aged 50–78 years led to a decrease in total days of self-reported illness and total days of antibiotic use during 1 year [24]. Multivitamin-mineral (MVM) supplementation among adults aged >45 years led to significantly fewer infection-related illnesses and infection-related absenteeism days, including among adults with diabetes [25]. Supplementation with Centrum multivitamin is demonstrated to significantly reduce the period prevalence of acute upper respiratory tract infections, suggesting an enhanced immune resilience due to supplementation [26].

While there is an accumulation of research regarding the physiological effects of multivitamin supplementation [27], there is a paucity of data on patients' perceived effectiveness of multivitamin supplementation, particularly on QoL and wellbeing in the Indian population. Furthermore, healthcare systems have increasingly acknowledged the need to recognize patients' perspectives and involve them in shared decision-making. The understanding of patients' and physicians' perspectives is crucial to informing patient-provider communication in routine practice and enhancing patient satisfaction. To enable such understanding, patient-reported outcome measures can be considered, which involve the use of standardized, validated questionnaires that collect information on health-related outcomes directly from patients, allowing for reliable inferences to be made regarding health-related quality-of-life (HRQoL), functional status and symptoms in a real-world setup [28].

MATERIALS AND METHODS

Study design and study population

This was an observational study carried out at multiple sites in India. Using an online questionnaire, patient-reported outcome measure data was obtained from 80 HCPs who were recruited using the following criteria: (i) practicing in either general medicine, or obstetrics and gynecology, or orthopedics; (ii) at least 2 years' experience of practice; (iii) at least 50% of time spent in direct patient care; (iv) managing at least 100 patients a month; (v) routinely collecting at least 3 of the following patient-reported outcomes in practice: EuroQoL 5-dimension 5-level scale (EQ-5D-5L), Patient-Reported Outcomes Measurement Information System (PROMIS) Cognitive Function abilities short form 6a, single-item immune fitness and reduced immune fitness rating, visual analog scale (VAS) 100 mm for energy, VAS 100 mm for joint pain, VAS 100 mm for stress; (vi) seen at least 10 patients in the past 1 year who have been regularly taking Centrum multivitamin for 3 months or more, or planning to recommend Centrum multivitamin (Men/ Women/ Adults 50+) to at least 10 patients in the next one month; (vii) able and willing to provide consent to participate in this study. The composition of the study products is given in Table 2.

Table 2. Composition of Centrum multivitamin formulations used in this study [16-18]

Component	Centrum Men	Centrum Women	Centrum Adults 50+
Vitamin A	800 mcg	800 mcg	800 mcg
Vitamin C	80 mg	65 mg	65 mg
Vitamin D2	600 IU	600 IU	600 IU
Vitamin E	5 mg	9 mg	9 mg
Biotin	25 mcg	25 mcg	25 mcg
Folate	200 mcg	220 mcg	220 mcg
Vitamin B12	2.2 mcg	2.2 mcg	2.2 mcg
Vitamin B1	1.2 mg	1 mg	1 mg
Vitamin B2	1.2 mg	1 mg	1.1 mg
Vitamin B3	15 mg	14 mg	11 mg
Vitamin B5	5 mg	5 mg	5 mg
Vitamin B6	1.3 mg	1.3 mg	1.3 mg
Vitamin K	55 mcg	55 mcg	55 mcg
Calcium	250 mg	325 mg	250 mg
Iron	3.7 mg	4.4 mg	4.4 mg
Zinc	11 mg	11 mg	11 mg
Iodine	140 mcg	140 mcg	140 mcg
Magnesium	66 mg	66 mg	66 mg
Manganese	1.2 mg	1.8 mg	2.3 mg
Copper	0.45 mg	0.45 mg	0.9 mg
Selenium	40 mcg	40 mcg	40 mcg
Chromium	17.5 mcg	30 mcg	30 mcg
Molybdenum	45 mcg	45 mcg	45 mcg
Additional component	Grape seed extract 100 mg	Sodium hyaluronate 5 mg	<i>Boswellia serrata</i> extract 250 mg

The sample size calculation for patients was determined based on the estimated effect of change in patient-reported outcomes. A sample size of 200 is sufficient to show a 20% difference in patient-reported outcomes at a 5% significance level, with 80% power. Patients were excluded in case of: (i) self-reported physician-diagnosis of conditions including cancer, autoimmune conditions, or HIV/AIDS; (ii) current participation in any clinical trials; (iii) pregnancy or breastfeeding.

Data collection

Data was collected both prospectively and retrospectively. Prospective data collection (Figure 1A) was undertaken for adults aged 18 years and older who had not taken Centrum multivitamin regularly before consultation and intended to consume Centrum multivitamin regularly (one tablet per day) for at least three months. Inclusion criteria were (i) scheduled to return to the clinic for a follow-up consultation visit after at least 3 months and within 4 months, (ii) able to read and comprehend, and well enough to answer questions in the online questionnaires, and (iii) able and willing to provide consent to participate in the study.

Retrospective data collection (Figure 1B) was undertaken for patients who had already started taking Centrum multivitamin/were recommended to start taking Centrum multivitamin during their previous visit, if the records included the following patient-reported outcome measures before consuming Centrum multivitamin: EQ-5D-5L, PROMIS Cognitive Function abilities short form 6a, single-item immune fitness and reduced immune fitness rating, VAS 100 mm for energy, VAS 100 mm for joint pain, VAS 100 mm for stress, and any of the following parameters on (i) number of sick days over the past month, (ii) physical activity, (iii) high blood pressure, (iv) heart palpitation and (v) skin radiance. The subjects were included if they were scheduled to return to the clinic for a follow-up consultation visit within 4 months of regular Centrum intake (one tablet per day) if the PROs measures were not collected after 3 months of regular Centrum intake, and were able to read and comprehend, and well enough to answer the questions in the online questionnaire.

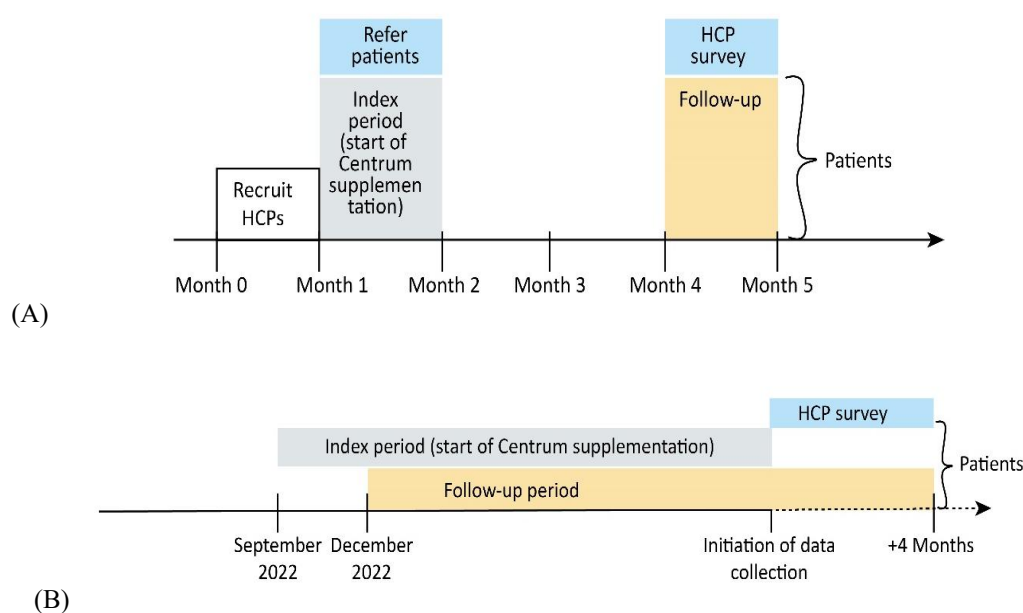


Figure 1. Design of the study (A) Prospective data collection (B) Retrospective data collection

^a Index period: Sociodemographic characteristics, medical history and PROs collected prior to starting Centrum any time during this period.

^b Follow-up period: Details on Centrum consumption and PROs collected after 3 months of regular (1 tablet a day) Centrum intake.

HCPs: Healthcare practitioners; PROs: Patient-reported outcomes.

The HCPs provided anonymized patient data for patients who met the eligibility criteria by completing online surveys at two time-points. To maintain confidentiality, each patient was assigned a unique participant identifier upon study enrolment. Patient information included: (i) sociodemographic factors; (ii) medical history; and (iii) details of Centrum, multivitamin supplementation and pattern of consumption (iv) self-reported health and quality of life before and after Centrum multivitamin supplementation using the following patient-reported outcome measures detailed below.

Outcome measures

The EQ-5D-5L was used as a generic measure of self-reported health to assess five dimensions for describing health states: mobility, usual activities, self-care, pain and discomfort, and anxiety and depression. The questionnaire comprises two parts. The first is the EQ-5D descriptive system, wherein respondents are asked to tick boxes to indicate the level of problem they experience on each of the five dimensions. Each of the dimensions was rated using five levels, i.e., no, mild, moderate, severe and extreme or unable to. The second part of the questionnaire is the EuroQoL visual analog scale (EQ-VAS), which incorporates a VAS to measure the respondent's overall assessment of their health on a scale from 0 (worst health imaginable) to 100 (best health imaginable) [29]. A local value set derived from the Indian general population was applied to generate the utility scores, with the scores ranging from -0.923 to 1. Negative values, '0' and '1' correspond to 'worse than dead', 'dead' and 'full health', respectively. Mean (and standard deviation [SD]) of the EQ-5D-5L index score and EQ-VAS were calculated. The proportion of subjects who indicated respective levels for each of the five dimensions in EQ-5D-5L was calculated.

A single-item patient-reported outcome measure on immune fitness was evaluated. Respondents rated their self-perceived immune fitness at the time of survey using a 0-10 scale, with 0 and 10 corresponding to 'Very poor' and 'Excellent', respectively. The mean (and standard deviation [SD]) of the T-score were calculated for baseline, follow-up, and statistical significance of the difference between follow-up and baseline. The single item assessing reduced immune fitness was administered together with the single-item immune fitness questionnaire. The single item assessing reduced immune fitness is a single item assessing the respondent's experience with reduced immune fitness at the time of the survey. Using a Yes/No response scale, respondents indicated if they were experiencing reduced immune fitness. The proportion of patients in each category was calculated before and after Centrum multivitamin supplementation. Investigator-designed items were used to assess the mean number of sick days over the past month before and after Centrum supplementation.



No administration of any therapeutic agent and no procedures were required in the study, and no adverse events (AEs) were solicited throughout this study. However, spontaneously reported events were reported.

Statistical analysis

Descriptive analyses were performed to describe the baseline characteristics of enrolled HCPs and of patients including sociodemographic, medical history, and compliance by patients. Continuous variables were reported as mean (and SD) or median and range where appropriate. Categorical variables were summarized as number and proportion of the total study population, and by subgroups where appropriate. Paired sample t-tests were used to determine the significance of difference in mean scores pre- and post-multivitamin supplementation. Chi-squared test was used to determine the significance of differences in proportion of subjects with respective health states before and after Centrum supplementation. The level of significance was set at 5%. All analyses were performed using SAS statistical software (version 9.4).

Ethical approval

This study protocol and its amendments, along with the Informed Consent Form, were reviewed and approved by the Suraksha Ethics Committee, India [Registration No.: ECR/644/Inst/MH/2014/RR-20, OHRP No.: IORG0008323]. This study was conducted in accordance with the appropriate ethical guidelines including the Declaration of Helsinki, and all applicable privacy laws and local regulations for each participating site. Written informed consent was obtained from all participants included in the study.

RESULTS

Demographics

A total of 614 patients were included in the analysis, 203 who took Centrum Men, 210 who took Centrum Women and 201 who took Centrum Adults 50+ (male: 54%; female: 46%). Diabetes mellitus was the most common co-morbid condition across all three groups, followed by hypertension. Stroke was more common among participants in the Centrum Adults 50+ group (Table 3). No comorbidities were reported for 34.5% of users of Centrum Men, 48.1% of users of Centrum Women, and 5% of users of Centrum Adults 50+. All patients were receiving treatment for their comorbid conditions, if any. Over half of users of Centrum Men were overweight while 14.8% were obese, compared with 41.9% of users of Centrum Women who were overweight and 20% were obese (Table 3).

Table 3. Demographic characteristics of the study group

Parameter	Centrum Men (n=203)	Centrum Women (n=210)	Centrum Adults 50+ (n=201)
Median age, years (IQR, Q1-Q3)	39.0 (33.1–44.9)	38.0 (30.9–42.5)	59.0 (59.9–65.2)
Median BMI, kg/m ² (IQR, Q1-Q3)	26.2 (24.2–28.6)	26.0 (23.2–29.4)	26.1 (23.5–29.4)
BMI category			
Underweight, n (%)	2 (1.0)	3 (1.4)	0 (0)
Normal, n (%)	58 (28.6)	77 (36.7)	76 (37.8)
Overweight, n (%)	113 (55.7)	88 (41.9)	80 (39.8)
Obese, n (%)	30 (14.8)	42 (20.0)	45 (22.2)
Highest education level, %			
Primary	9.9%	6.2%	39.3%
Secondary	21.7%	26.2%	28.9%
University or post-graduate	63.5%	64.8%	23.4%
Other technical education or training	4.9%	2.9%	8.5%
Co-morbid conditions, n (%)			
Diabetes mellitus	73 (36.0)	49 (23.3)	118 (58.7)
Hypertension	68 (33.5)	45 (21.4)	112 (55.7)
High cholesterol	27 (13.3)	20 (9.5)	47 (23.4)
Stroke	8 (3.9)	6 (2.9)	34 (16.9)
Arthritis	15 (7.4)	19 (9)	38 (18.9)
Dementia	12 (5.9)	14 (6.7)	10 (5.0)
No co-morbid conditions	70 (34.5)	101 (48.1)	10 (5.0)

BMI: Body mass index; IQR: Interquartile range.

Compliance with Centrum supplementation

High rates of compliance were observed, with 99% of participants still taking Centrum at the time of follow-up. All participants had taken Centrum for at least 3 months. Figure 2 depicts the frequency of consumption of Centrum. Consumption of Centrum for at least three days a week was noted for 97% of users of Centrum Men, 92.8% of users of Centrum Women, and 99.5% of users of Centrum Adults 50+.

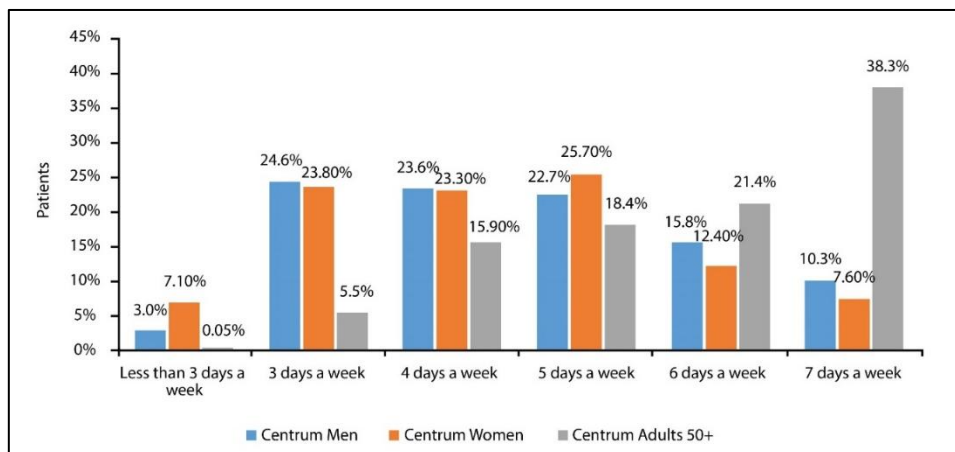
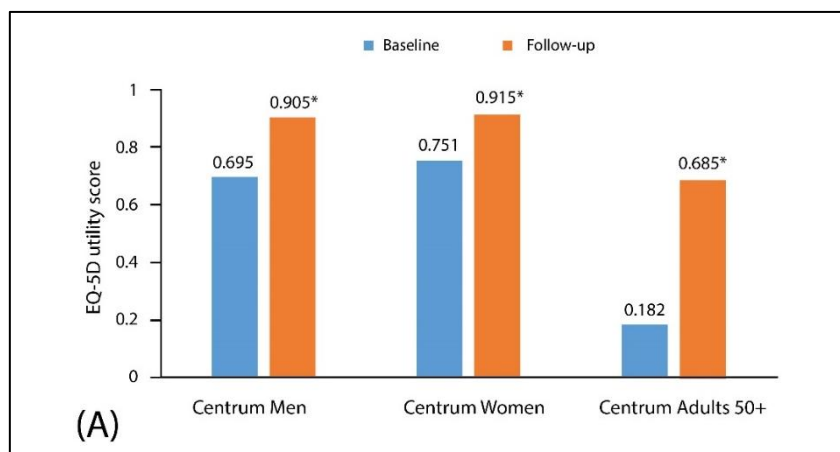
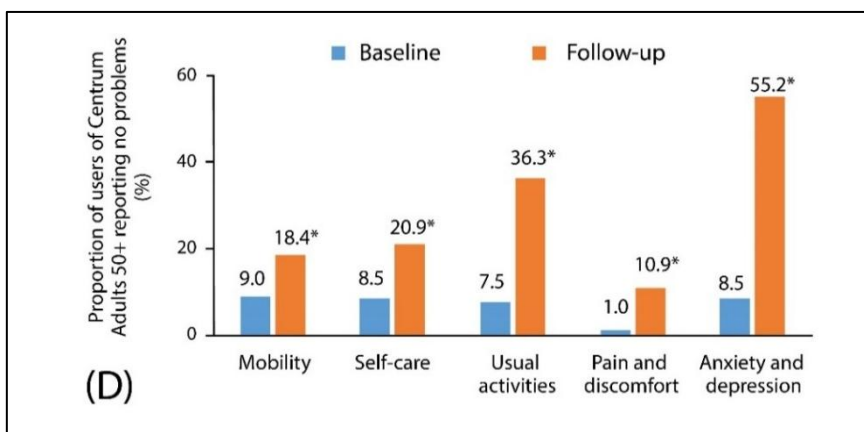
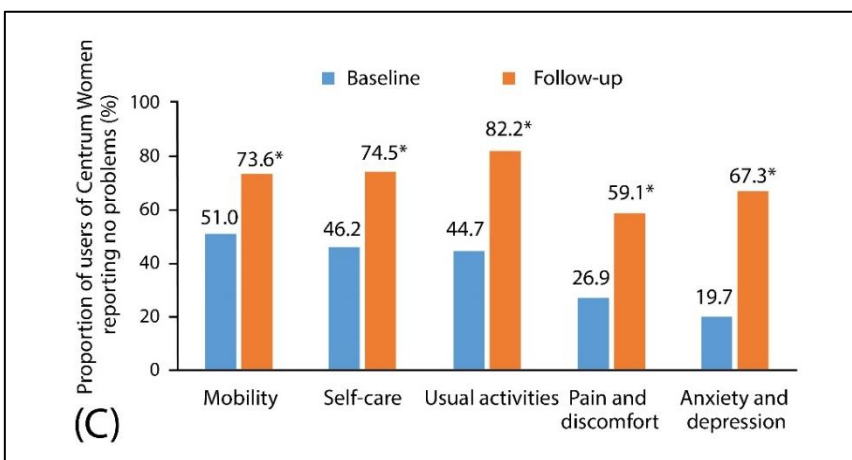
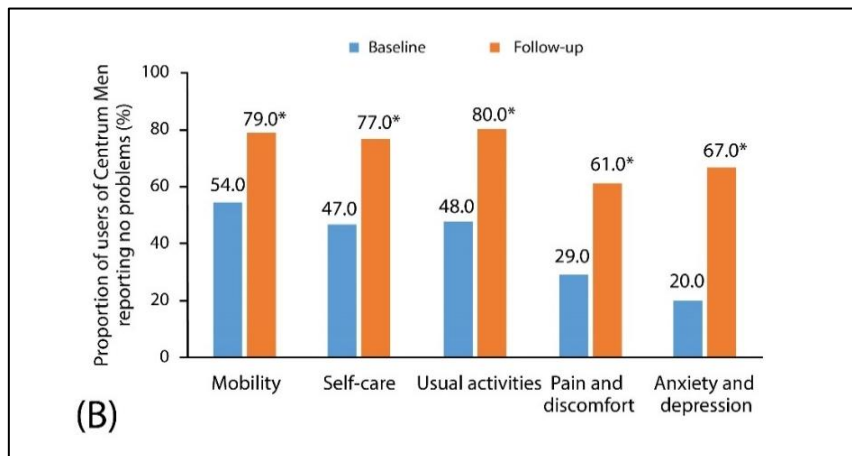


Figure 2. Consumption pattern for users of Centrum Men, Centrum Women and Centrum Adults 50+

Quality-of-life outcomes

Data was analyzed after 3 months of supplementation. Improvement in QoL after supplementation with Centrum multivitamin was demonstrated by higher EQ-5D utility score compared with baseline in all three groups (Figure 3A). Significant improvements were observed for all EQ-5D dimensions (mobility, self-care, usual activities, pain and discomfort, and anxiety and depression) as shown in Figures 3B, 3C and 3D. QoL improvement experienced by participants is further supported by a significant increase in mean EQ-VAS scores compared with baseline (Figure 3E).





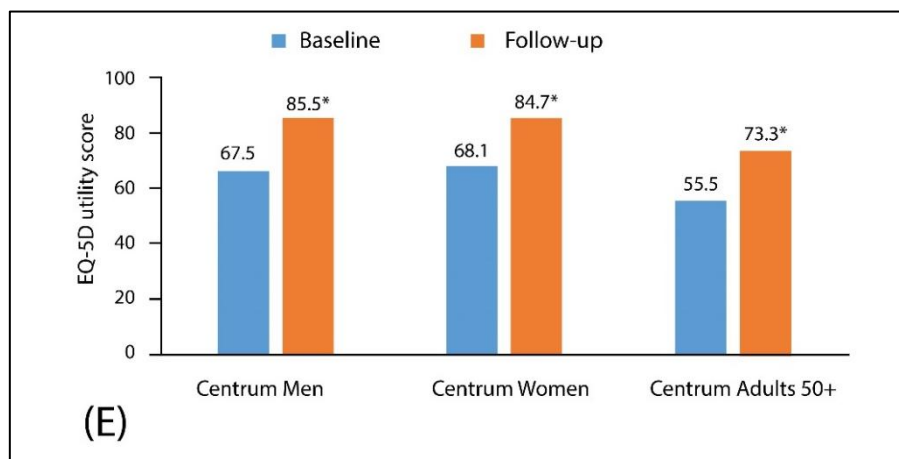


Figure 3. Significant improvement in: (A) Mean EQ-5D utility score for all three groups; (B) All dimensions of the EQ-5D-5L for users of Centrum Men; (C) All dimensions of the EQ-5D-5L for users of Centrum Women; (D) All dimensions of the EQ-5D-5L for users of Centrum Adults 50+; and (E) Mean EQ-VAS for all three groups

EQ-5D-5L: EuroQoL 5-dimension 5-level scale; EQ-VAS: EuroQoL visual analog scale. * $p < 0.05$ vs. baseline.

Immune function

Patients reported improved immune fitness rating after consumption of Centrum Men ($p < 0.001$), Centrum Women ($p < 0.001$) and Centrum Adults 50+ ($p < 0.001$). A lower proportion of patients reported having reduced immune fitness after supplementation in all three groups, along with reduction in the number of sick days compared with baseline (Table 4).

Table 4. Improvement in immune fitness rating and fewer sick days in all three groups after Centrum supplementation

Parameter	Centrum Men		Centrum Women		Centrum Adults 50+	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
Immune fitness rating, mean (SD)	7 (1.4)	8.9 (1)*	7 (1.4)	8.7 (1)*	5.6 (1.9)	7.6 (1.5)*
Reduced immune fitness, n (%)	116 (57.4)	3 (1.5)*	99 (47.4)	4 (1.9)*	147 (73.1)	1 (0.5)*
No. of sick days, mean (SD)	3.8 (2.6)	1.8 (1.3)*	3.8 (2.2)	1.9 (1.3)*	6.0 (3.7)	3.0 (2.4)*

* $p < 0.001$ vs. baseline. NA: Not applicable; SD: Standard deviation; VAS: Visual analog scale.

Adverse effects

No AEs were solicited throughout this study, as it was based on the existing patient records. No AEs were reported by the study participants.

DISCUSSION

The findings of this study highlighted that MVM supplementation among adults led to significant improvements in QoL measures and mobility. This simple and safe approach can be an effective tool to improve the health of adults with varying co-morbid conditions. Improving the quality of health care is important, and the use of patient-reported outcome measures, such as QoL, provides an understanding of the burden of disabilities that are crucial to patient health and well-being. The EQ-5D provides a generic method of evaluating health profile across a range of health problems, and therefore the EQ-5D can be used across a range of conditions [30,31].

This study included adults with co-morbid conditions such as hypertension, diabetes and high cholesterol. Studies have shown that individuals with such conditions have poorer EQ-5D-5L score. Compared with normotensive individuals, hypertensive individuals have significantly lower scores on all domains of the EQ-5D and its utility index, and greater severity of hypertension is associated with lower EQ-VAS and utility scores [32,33]. Abedini, et al., reported that patients with diabetes mellitus have moderate and severe

issues for anxiety/depression, pain/discomfort, and mobility [34]. In an attempt to detail the nutritional requirements of the elderly in India, it has been suggested that the physiological and metabolic changes in the elderly should be accounted, and global guidelines could be adapted for the Indian population. Additionally, the association of dietary intake with QoL must be evaluated [35]. The present study demonstrated that MVM supplementation led to significant improvement in QoL scores among, and was in concurrence with previous studies which reported that MVM use is associated with better self-reported overall health across all race, sex and education groups, and in individuals under 65 years of age [36].

Indian guidelines recommend supplementation of 1,000-2,000 IU per day for vitamin D deficiency [37]. There is considerable variation in global recommended dietary allowances (RDAs) for vitamin C, as some countries base the values on prevention of deficiency while others base it on body pool. The RDA varies from 40 mg/d in the UK and India to 110 mg/d in a number of European countries [38]. Guidelines from National Institute for Health and Care Excellence (NICE) recommend vitamin B12 of at least 1 mg/day for adults with deficiency caused by malabsorption [39]. An Indian Council of Medical Research (ICMR)-led multiple micronutrient supplement (MMS) design expert group has recently recommended a formulation for pregnant women in India including not only iron and folate, but also other key vitamins and minerals [40]. An Expert Consensus by the India Chapter of the American College of Physicians recommends dietary requirements as well as micronutrient supplementation for adults with a combination pill including vitamins A, D, E, and B (B1, B2, B3, B6, B9, B12), and vitamin C, and minerals, including copper, selenium, zinc, and magnesium [41].

Apart from its role in bone health, vitamin D has pleiotropic effects, and plays a role in modulating insulin secretion, regulation of the renin-angiotensin-aldosterone system, preservation of endothelial function, and improving immunity. In a study by Chao, et al., individuals with higher serum 25(OH)D levels had higher HRQoL levels assessed by the EQ-5D. The study reported that at a HRQoL score of 0.5, individuals had a 29% increase in HRQoL score with a 100 nmol/L increase in 25(OH)D [42,43]. The B vitamins are involved in several enzymatic processes wherein they act as coenzymes, and thus, B vitamins are crucial for a majority of cellular functions, including energy metabolism and neuronal functions [44]. Supplementation with vitamin B12 and folic acid has an incremental effect on HRQoL among older adults with mild hyperhomocysteinemia [45].

Impaired mobility negatively impacts functional status and ability to participate in activities and therefore lowers general health perception and QoL. It is widely accepted that mobility is a key aspect in measuring HRQoL [46]. Supplementation with B vitamins, vitamin E, and taurine is demonstrated to reduce fatigue. Vitamins and minerals play a role in energy metabolism through their function as antioxidants [47]. Our study reported an improvement in mobility, usual activity, as well as pain and discomfort, indicating an improvement in QoL.

This study demonstrated that Centrum multivitamin supplementation for at least 3 months led to significant improvement in QoL and perceived immunity. Overall, 99% of users of Centrum Men and Centrum Adults 50+ reported no more reduced immune fitness, and 50% reduction in number of sick days, while 98% of users of Centrum Women reported no more reduced immune fitness and a 50% reduction in the number of sick days. Immune fitness rating improved by 27%, 24%, and 35% for users of Centrum Men, Centrum Women, and Centrum Adults 50+, respectively. The increase in self-perceived immune function was reflected in the reduction in the number of sick days.

Micronutrients play a crucial role in innate and adaptive immunity through maintenance of structural integrity of mucosal cells, differentiation of immune cells, antimicrobial effects, antioxidant effects, and antibody production. Suboptimal levels of micronutrients lead to impaired immune function and predisposition to a variety of infections, including increased frequency and higher severity. The sequelae of infections, such as morbidity, can impact QoL by varying degrees [48,49]. Fantacone, et al., demonstrated that supplementation with an MVM containing vitamin C, vitamin D, zinc led to improved serum levels of vitamin C and zinc, with concomitant decrease in reported length and severity of illnesses [50]. Therefore, optimal micronutrient status is important in maintaining immune function.

The evaluation of HRQoL is an important component of healthcare, being a multi-dimensional concept used for the evaluation of the physical and mental status of individuals, and the impact of the physical condition of an individual on QoL. After supplementation with Centrum Adults 50+, two times more participants reported no problem in mobility, four times more participants reported no problem in performing usual activities, ten times more participants reported no problems in pain and discomfort, and two times more participants reported no problem with self-care compared with baseline. The limitations of the study include the observational study design, shorter follow-up duration, and the lack of active comparators or placebo.

CONCLUSION

This holistic view of health state permits evaluation of disease progression, response to treatment, and treatment decisions. This study demonstrated the impact of an MVM supplement on improving HRQoL parameters among adults in India, many of whom had co-morbid chronic conditions. Improved HRQoL was accompanied by improved self-perceived immune function which was



reflected in the reduction in number of sick days in the previous month. Enhancing physiological processes through supplementing critical vitamins which have an extensive range of functions can help in improving various aspects of HRQoL, both physical and mental. Further studies are warranted in Indian population to establish role of MVMs in comorbidities.

DECLARATIONS

Funding

This study was funded by Haleon India.

Author Contributions

All authors contributed to the study conception and design, data analysis, manuscript drafting and editing. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This study protocol and its amendments, along with the Informed Consent Form, were reviewed and approved by the Suraksha Ethics Committee, India [Registration No.: ECR/644/Inst/MH/2014/RR-20, OHRP No.: IORG0008323]. Written informed consent was obtained from all participants included in the study.

Competing interests

Dr. Atul Sharma, Tanya Bhagat, Dr. Prashant Narang and Dr. Jaya Abraham are on the payroll of Haleon India. Dr. Sheryl Tan is on the payroll of Haleon Singapore.

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How to cite this article:

Tanya Bhagat et al. *Jcpr.Human*, 2025; Vol. 21 (10): 1-12

Conflict of Interest Statement:

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