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ORIGINAL RESEARCH

A real-world evidence study evaluating consumer experience of Supradyn Recharge or Supradyn Magnesium and Potassium during demanding periods

Barbara Moroni[1], Veronika Óvári[2], Cristina Nicastro[1], Raffaella de Salvo[2], Andreas Ehret[2]

[1]Bayer S.p.A., Milano, Italia; [2]Bayer Consumer Care AG, Basel, Switzerland

Abstract

Background: Challenging periods and/or mild micronutrient deficiencies may result in a lack of energy and general fatigue, frequently occurring in the general population. Supradyn Recharge and Supradyn Magnesium and Potassium (Mg/K) are multimineral/vitamin supplements formulated to ensure adequate daily intake of micronutrients. We conducted an observational study addressing consumption behaviour, reasons for intake, frequency of intake, and consumer experiences, satisfaction and characteristics under real-life conditions.

Methods: This was a retrospective, observational study carried out with two computer-aided web quantitative interviews.

Results: A total of 606 respondents (almost equally split between men and women; median age 40 years) completed the questionnaires. The majority indicated having a family, a job and a good level of education; they stated to be long-time and daily users, reporting an average daily intake of 6 days a week. More than 90% of consumers claimed they were satisfied, would use the products again and recommend them; over two-thirds felt the value for money was good. Supradyn Recharge has been mainly used to support lifestyle change and mental resilience, seasonal changes, and post-illness recovery. Supradyn Mg/K has been used to sustain or regain energy levels during hot weather or physical activity and as a support against stress. Users claimed a positive impact on quality of life.

Conclusion: Overall, the perception of benefit by consumers was extremely positive as reflected in their consumption behaviour, the majority of whom stated to be long-time users and daily consumers, with an average daily intake of 6 days for both products. These data complement and add up to the results of Supradyn clinical trials.

Keywords: consumer experience, multimineral, multivitamin, Supradyn.

Citation

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Introduction

Vitamins and minerals, such as vitamin C and group B vitamins, magnesium, calcium, iron, zinc, manganese, copper and sulfur as well as coenzyme Q10 (CoQ10), which drives adenosine triphosphate (ATP) synthesis, are essential in many cellular processes, including energy production, anabolic metabolism and brain function. As they are strongly interrelated in various metabolic pathways, their adequate supply is crucial for normal physical and mental functioning.[1–3] Poor mood, irritability, difficulty in focusing and impaired cognition may result from sub-optimal levels of these micronutrients and the inability to meet metabolic demands.[4,5] Throughout Europe, micronutrient intake varies substantially according to country, diet, age and sex, with sub-optimal micronutrient intake observed for vitamins A, B, C, D and E, folate, iron, zinc, calcium, copper, magnesium, iodine, and selenium.[6,7]

Enzyme activity and energy production can be impaired during mentally and/or physically demanding periods

as well as by mild deficiencies in micronutrients, even in 'healthy' adults, which can lead to a general lack of energy and fatigue.[3] In fact, the general population often experiences low energy, physical and mental fatigue, and negative effects on cognitive performance.[8,9] Fatigue is a common complaint amongst individuals, particularly in women, who seek medical attention for unexplained symptoms.[9] Fatigue has important clinical relevance, as it can affect the health status, performance and quality of life (QoL) of individuals, both indirectly and directly.[10,11]

Supradyn Recharge and Supradyn Magnesium and Potassium (Mg/K) are food supplements with vitamins and minerals (Table 1) specifically formulated to ensure an adequate daily intake of micronutrients in cases of increased physiological need (such as after an illness or following seasonal changes) and/or reduced micronutrient intake with the normal diet.[12,13] Previous observational and randomized, blinded, and controlled trials have shown beneficial effects of vitamin/mineral supplementation, including with Supradyn, in terms of nutritional status, psychological and physical functioning,

Table 1. Formulation content of Supradyn Recharge and Supradyn Magnesium and Potassium.

	Supradyn Recharge		Supradyn Magnesium and Potassium	
	One-tablet content	**RNI (%)**	**One-sachet content**	**RNI (%)**
Vitamins				
A	800 µg	100%	–	–
D	5 µg	100%	–	–
E	12 µg	100%	–	–
K	25 µg	33%	–	–
C	180 mg	225%	250 mg	313%
B1 (thiamine)	3.3 mg	300%	2.1 mg	191%
B2 (riboflavin)	4.2 mg	300%	–	–
B3 (niacin)	48 mg	300%	–	–
B5 (pantothenic acid)	18 mg	300%	–	–
B6 (pyridoxine)	2 mg	143%	3 mg	214%
B8 (biotin)	50 µg	100%		
B9 (folic acid)	200 µg	100%	200 µg	100%
B12 (cobalamin)	3 µg	120%	9 µg	360%
Minerals				
Calcium	120 mg	15%	–	–
Magnesium	80 mg	21%	225 mg	60%
Potassium	–	–	300 mg	15%
Iron	14 mg	100%	–	–
Copper	1 mg	100%	–	–
Manganese	2 mg	100%	–	–
Selenium	50 µg	–	–	–
Molybdenum	50 µg	100%	–	–
Iodine	15 µg	100%	–	–
Zinc	10 µg	100%	–	–
Other(s)			–	–
Coenzyme Q10	4.5 mg	–	–	–

RNI, recommended nutrient intake.

and/or cognitive performance.[4,14–23] Benefits comprised enhanced energy levels, reduction in mental and physical fatigue, mental stamina, concentration, and mood improvements as well as reduced feelings of stress, depression and anxiety.[3,24]

Although the benefits of Supradyn have been widely investigated in clinical studies, evidence in uncontrolled, real-life settings was lacking. Therefore, we conducted an observational study through online questionnaires to collect retrospective information from consumers about their experience with the products used in real-life conditions. The present paper reports on our findings on consumption behaviour, reason for intake and frequency of intake as well as consumer experience, satisfaction and characteristics.

Methods

Study design

This was a retrospective observational study with primary data collection of real-life evidence through a computer-aided web quantitative interview. The protocol for retrospective data collection was agreed upon by experts from Bayer Consumer Health and IQVIA Inc. (Madrid, Spain), an independent agency. The study protocol was designed to collect information on adult Italian consumers using either Supradyn Recharge or Supradyn Mg/K within 6 months before participation in the study. The field phases for the two surveys took place over two different periods, namely May–June 2022 for Supradyn Recharge and July–August 2022 for Supradyn Mg/K. Participants were identified via existing consumer panels and were informed about the survey through e-mails. Before the questionnaire, a short screening section was used to assess eligibility. Those who agreed to participate and fulfilled the inclusion criteria were requested to complete the entire survey, which was conducted on the Forsta online survey platform. IQVIA, Inc. conducted recruitment in Italy. Given the observational nature of this retrospective study, only a brief consent form was necessary for participation. All participants provided written informed consent before the study.

Approval of this protocol by an ethics committee was not required as this was an observational study with no involvement of healthcare providers, no collection of data from medical records and no collection of proactive safety signals. Therefore, a waiver of the ethics committee review was unnecessary.

Survey development

The Supradyn Recharge survey comprised 12 questions in the screening section and 18 questions in the actual questionnaire, whilst the Supradyn Mg/K survey comprised 12 questions in the screening section and 11 questions in the actual questionnaire. The questions were standardized and formulated in a way that was clear, unambiguous and easy for consumers to understand, without any technical jargon. Additionally, they were not designed to lead or bias the respondent. The questionnaire asked about respondent demographics, diet, reasons for intake, intake frequency, impact on QoL, and consumer benefits and satisfaction. The survey questions whose answers have been reported in the present study are provided in the Supplementary Materials.

Respondents were presented with a predetermined list of options to select unambiguous answers to the questions. No open-ended responses were permitted, and the provided answers were phrased in a manner that was consumer friendly, self-explanatory and free of technical language. For several questions, respondents were asked to rate their answers using a 5-point Likert-type scale (1, strongly disagree/dissatisfied; 2, somewhat disagree/dissatisfied; 3, neither agree/satisfied nor disagree/dissatisfied; 4, somewhat agree/satisfied; 5, strongly agree/satisfied).

Survey population

The key inclusion criteria to participate in the study were (1) age of 25–65 years for Supradyn Recharge and 25–55 years for Supradyn Mg/K (in line with the market data on product usage); (2) having used the product within the previous 6 months; (3) having used the product at least 3 days a week when taking the product; and (4) being able to read and understand the survey. Participants had to provide written informed consent for voluntary participation in the study. Consistent with the methodology of real-world evidence, no exclusion criteria were defined. Participants were informed of the study's purpose and its intended application upon entry into the questionnaire.

Data collection and analysis

A participant ID was assigned to each survey respondent to preserve participant anonymity throughout the study. IQVIA managed all communication with study participants, obtained written informed consent for participation, gathered survey responses, and conducted data management and statistical analyses at an aggregate level.

The survey's primary aim was to collect data about the use of the two Supradyn formulations.

Availability of data and material

Data are available from the authors upon reasonable request.

Sample size, power and statistical analysis

Assuming a 5% error margin, a 0.5 standard deviation and a 95% confidence level, a sample size of approximately 400 participants was considered sufficient for the Supradyn Recharge survey, with a soft quota of at least 100 for each gender group.[25] As Supradyn Mg/K has a significantly lower market penetration than Supradyn Recharge, a sample size of 200 consumers (100 women and 100 men) was assumed to be sufficient to represent the overall population. However, due to the real-world design of the study, there were no restrictions on the maximum number of participants who could be included.

The survey findings are presented with standard descriptive statistics, with numbers and percentages of respondents based on the total number of respondents unless otherwise stated.

Results

Respondent characteristics

A total of 604 people – namely 404 for Supradyn Recharge and 200 for Supradyn Mg/K – provided completed questionnaires valid for data analysis. In particular, for Supradyn Recharge, 477 respondents were qualified and completed the questionnaire; 73 failed the quality check, resulting in 404 evaluable respondents who passed the quality check and their answers were included in the analysis. For Supradyn Mg/K, 218 respondents were qualified; 200 passed the quality check and their answers were included in the analysis. The demographic characteristics of the respondents are provided in Table 2. There was almost an equal split between men and women. In both groups, most people were aged 46–55 years (median age 39 and 40 years for Supradyn Recharge and Supradyn Mg/K, respectively), married

Table 2. Respondent demographic characteristics.

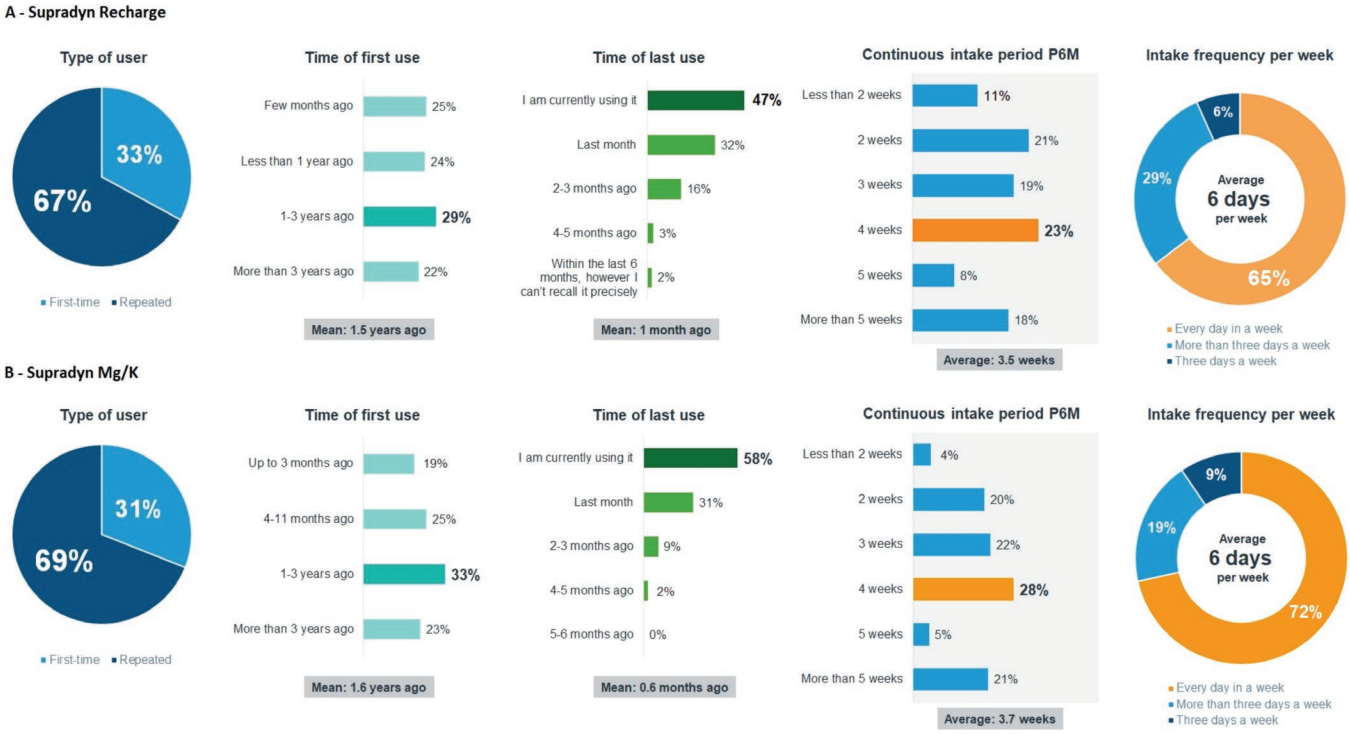
Supradyn Recharge (*n*=404), %		Supradyn Magnesium and Potassium (*n*=200), %	
Sex			
Men	52	Men	100
Women	48	Women	100
Other	0	Other	0
Age			
25–35 years old	34	25–35 years old	27
36–45 years old	45	36–45 years old	51
56–55 years old	20	56–55 years old	22
56–65 years old	1		
Marital status			
Single, never married	25	Single, never married	31
Married	73	Married	67
Separated	2	Separated	2
Educational level			
Primary school	0	Primary school	0
Lower secondary school	4	Lower secondary school	3
Upper secondary school	35	Upper secondary school	32
University	46	University	49
PhD/Masters	15	PhD/Masters	16
Occupation			
Employed for wages	69	Employed for wages	72
Self-employed	16	Self-employed	12

(*Continued*)

Table 2. (Continued)

Supradyn Recharge (*n*=404), %		Supradyn Magnesium and Potassium (*n*=200), %	
Occupation			
Homemaker	7	Homemaker	7
Out of work and looking for work	5	Out of work and looking for work	5
Student	2	Student	3
Out of work but not currently looking for work	<1	Out of work but not currently looking for work	1
Military	<1	Military	0
Retired	<1	Retired	0
Unable to work	0	Unable to work	0

Figure 1. Consumption behaviour for Supradyn Recharge (A) and Supradyn Magnesium and Potassium (B).



P6M, past 6 months.

and with higher education (i.e. high school/university degree). In both groups, most respondents were in employed jobs, followed by self-employed; these were followed by homemakers and unemployed job seekers in the Supradyn Recharge group and unemployed job seekers and homemakers in the Supradyn Mg/K group.

Supradyn Recharge

Consumption behaviour

The consumption behaviour of Supradyn Recharge by respondents is reported in Figure 1A; 67% (*n*=271) were repeat users, whilst 37% (*n*=133) were first-time users. The mean time of first use was 1.5 years before the survey, with most respondents (51%, *n*=206) having used the product from 1 to more than 3 years before the survey. The mean time of last use was 1 month before the survey, with almost half (46%, *n*=187) claiming they were currently using Supradyn Recharge and only a minority (5%, *n*=21) reporting that they had used it more than 4 months before the survey. Overall, 63% (*n*=254) of respondents had used the product continuously for 2–4 weeks in the 6 months before the survey, whilst 26% (*n*=105) had used it for 5 weeks or more. The average intake frequency was

Table 3. Characteristics respondents diet for those consuming of Supradyn Recharge.

Statement	% of respondents (*n*=404)
I do not eat meat	11
I do not eat poultry	4
I do not eat fish	8
I do not eat milk or dairy	8
I do not eat eggs or egg-containing food	3
I only eat raw food	2
I eat a substantial amount of meat/poultry/fish (at least 1–2 servings a day)	16
My diet is rich in carbohydrates	35
My diet is rich in fats	18
I eat at least two servings of fruit and vegetables a day	40
I do not follow any dietary restrictions	34
Respondents believe that their diet is…	
Rich in carbohydrates	35
Rich in fats	18
Animal protein-rich	16
Varied and balanced	2
Only composed of raw food	2
Pesco-vegetarian	1
Ovo-lacto-pesca-vegetarian	1
Vegan	1
Vegetarian	1
Ovo-lacto-vegetarian	1

6 days per week, with almost two-thirds of the respondents (65%, *n*=261) taking Supradyn Recharge daily. Two-thirds (67%, *n*=273) used the product in effervescent tablet form, 20% (*n*=80) used film-coated tablets and 13% (*n*=51) used both. Of the 324 (80%) effervescent tablet users, 86% (*n*=279) liked the taste, rating it as 'pleasant' or 'very pleasant' (data not shown). With regards to diet (Table 3), 40% stated eating at least two servings of fruit and vegetables a day, and 35% and 18% stated that their diet was rich in carbohydrates and fats, respectively; 34% did not follow any dietary restrictions, and only 2% were vegetarians or vegans.

Benefits sought, reasons for intake and intake frequency per reason

The life aspects of respondents that were negatively impacted before taking Supradyn Recharge included perceived tiredness (78%, *n*=317), normal daily activities, sports and leisure (44%, *n*=179), emotional life (44%, *n*=177), work/study performance (43%, *n*=175), sleep (40%, *n*=163), family life (26%, *n*=107), social life (19%, *n*=76) and none of the above (2%, *n*=7). Of the affected respondents, a percentage ranging from 45% to 58% (according to the specific item) rated the magnitude of the negative impact to be either high or very high (Figure 2A). The main benefits sought with Supradyn Recharge included relief of lack of energy (74%, *n*=299), relief of physical fatigue (72%, *n*=291), support against stress (55%, *n*=222), relief of mental fatigue (51%, *n*=206), improve focus or concentration (44%, *n*=178), and relief of lack of attention (28%, *n*=113) (Figure 2B). Most respondents indicated the need to support the body during lifestyle changes (61%, *n*=246), to support the body against stress (58%, *n*=234), and to support the body during seasonal change (55%, *n*=222) as their main reasons for intake, especially amongst repeat users *versus* first-time users; other reasons included supporting the body after falling ill (especially working users), supporting bone and joint wellness, and supporting menopause (Figure 2C). Overall, 80% (*n*=323) of respondents used the product to support lifestyle changes, stress resilience, or both (sum of respondents who used the product to support the body during lifestyle change and/or to support the body against stress); this percentage was higher amongst working than non-working users (data not shown). Amongst people taking Supradyn Recharge to be resilient to stress or to support the body during lifestyle changes or seasonal changes, or after becoming ill, around one-third took it every weekday (62%, 65% and 68%, respectively), whilst 38% took it 3 or more days a week (Figure 2D).

Consumer satisfaction

Results on consumer satisfaction are reported in Table 4. Overall, ≥80% of respondents agreed (i.e. voted somewhat agree/strongly agree) that Supradyn Recharge makes them feel energetic to start the week, sustains their energy level throughout the day, improves their QoL, improves their energy for sports and training, and makes them manage challenges in their work better. Indeed, 91% (*n*=378) of users were satisfied (i.e. voted somewhat satisfied/completely satisfied) (Table 3). The percentage of satisfied consumers was higher amongst daily users than non-daily users; 91% (*n*=367) of consumers would use Supradyn Recharge in the future again, and 78% (*n*=315) agreed that the product was good value for money (voted somewhat agree/strongly agree); 92% (*n*=372) of participants would recommend the product

Figure 2. Benefits sought, reasons for intake and intake frequency per reason of Supradyn Recharge. (A) Life aspects negatively impacted before taking Supradyn Recharge and magnitude of negative impact. (B) Benefits sought from the product. (C) Reasons for intake. (D) Intake frequency according to reason of intake. (E) Reason for intake amongst daily users.

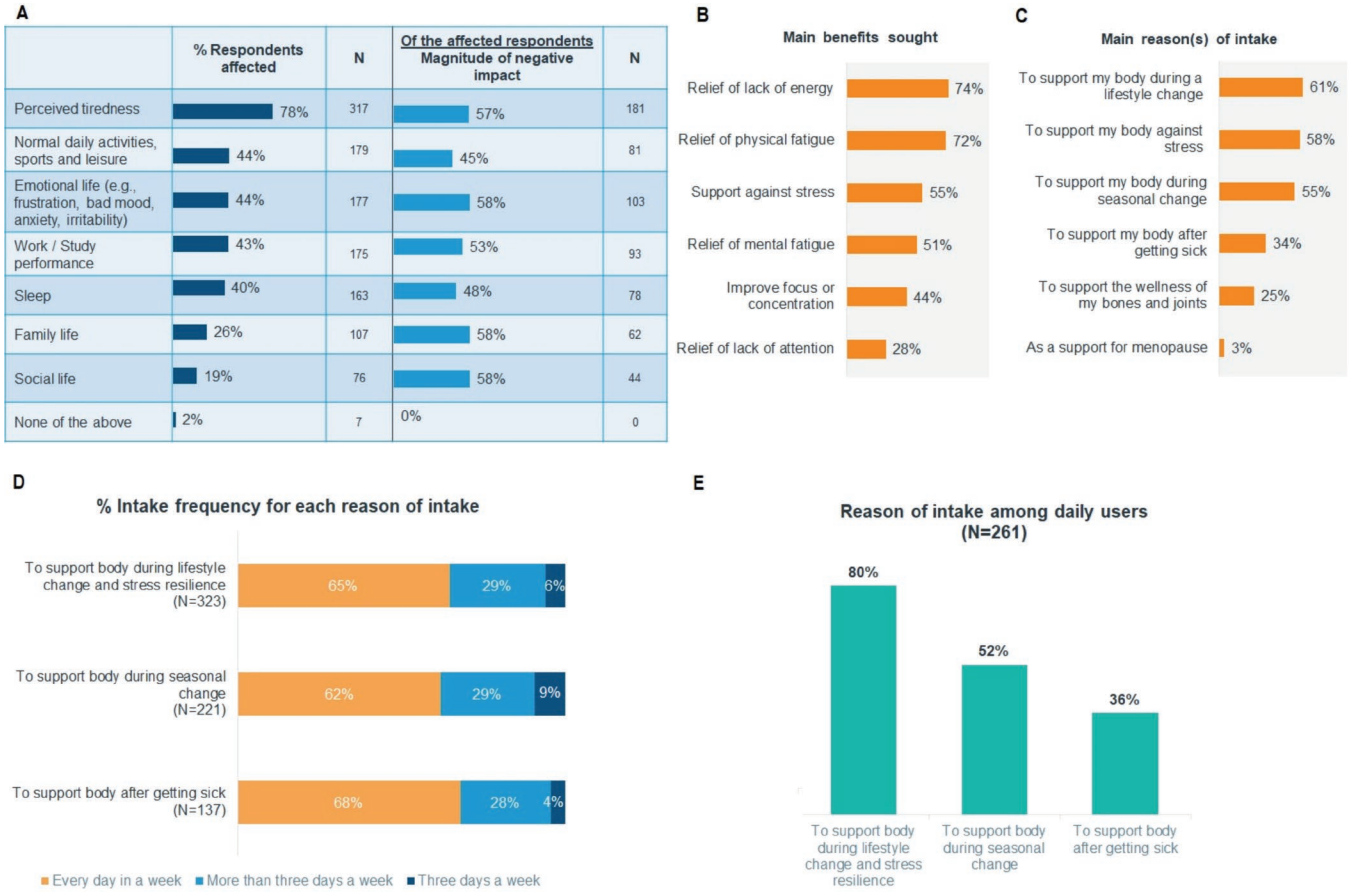


Table 4. Statements on consumer satisfaction.

Supradyn Recharge (*n*=404)	
Consumers taking the product to support lifestyle change, stress resilience or both (80%, *n*=323)	
With Supradyn Recharge, I feel more energetic and can better manage busy weeks	88%
With Supradyn Recharge, I have the energy I need throughout the day, even during a particularly busy day	87%
With Supradyn Recharge, I have more energy to better face new challenges in my work and personal life	86%
My work/study performance improved whilst taking Supradyn Recharge	85%
I feel supported against stress whilst I am taking Supradyn Recharge	84%
Consumers taking the product for seasonal change support (55%, *n*=221)	
With Supradyn Recharge, I start my day with grit and energy even in periods of seasonal change	86%
With Supradyn Recharge, I feel less 'grounded' and regain a good mood even in periods of seasonal change	85%
With Supradyn Recharge, I wake up with the desire to do things even in periods of seasonal change	79%

(*Continued*)

Table 4. (Continued)

Supradyn Recharge (*n*=404)	
Consumers taking the product to support post-illness recovery (34%, *n*=137)	
With Supradyn Recharge, after illness, I resume my daily habits with energy	82%
Having taken Supradyn Recharge, I returned to normal life after illness more quickly than expected	79%
Supradyn Magnesium and Potassium (*n*=200)	
Consumers taking the product to support body during hot weather (76%, *n*=152)	
Supradyn Mg/K helps me face my daily routine on the hottest days	94%
Supradyn Mg/K helps me face the hottest days with energy	93%
Supradyn Mg/K is my ally on the hottest days	93%
With Supradyn Mg/K, I feel energetic even in periods of very hot weather	91%
Supradyn Mg/K is my preferred way to replenish lost minerals in case of stuffiness,[a] with only one sachet per day	91%
Supradyn Mg/K makes me feel more energetic starting from the morning even on the hottest days	89%
Supradyn Mg/K is a concentrate of strength in case of stuffiness[a]	88%
Consumers taking the product to support body during physical exercise (69%, *n*=137)	
Supradyn Mg/K is my ally against fatigue due to sports activities	92%
Supradyn Mg/K is my preferred way to replenish lost minerals in case of sports, with only one sachet per day	90%
In relation to the intake of Supradyn Mg/K, I feel that I have a good level of energy and strength to perform during sports/physical activities	88%
Having taken Supradyn Mg/K, I regain energy after physical activities quicker than expected	87%
Supradyn Mg/K makes me feel more energetic in case of increased sweating	86%
Supradyn Mg/K is a concentrate of strength in case of sports	80%

[a]Stuffiness refers to a weather condition that feels unpleasantly warm/hot and humid, making a person feel sweaty and uncomfortable.

to friends and family (i.e. voted would probably recommend/would strongly recommend).

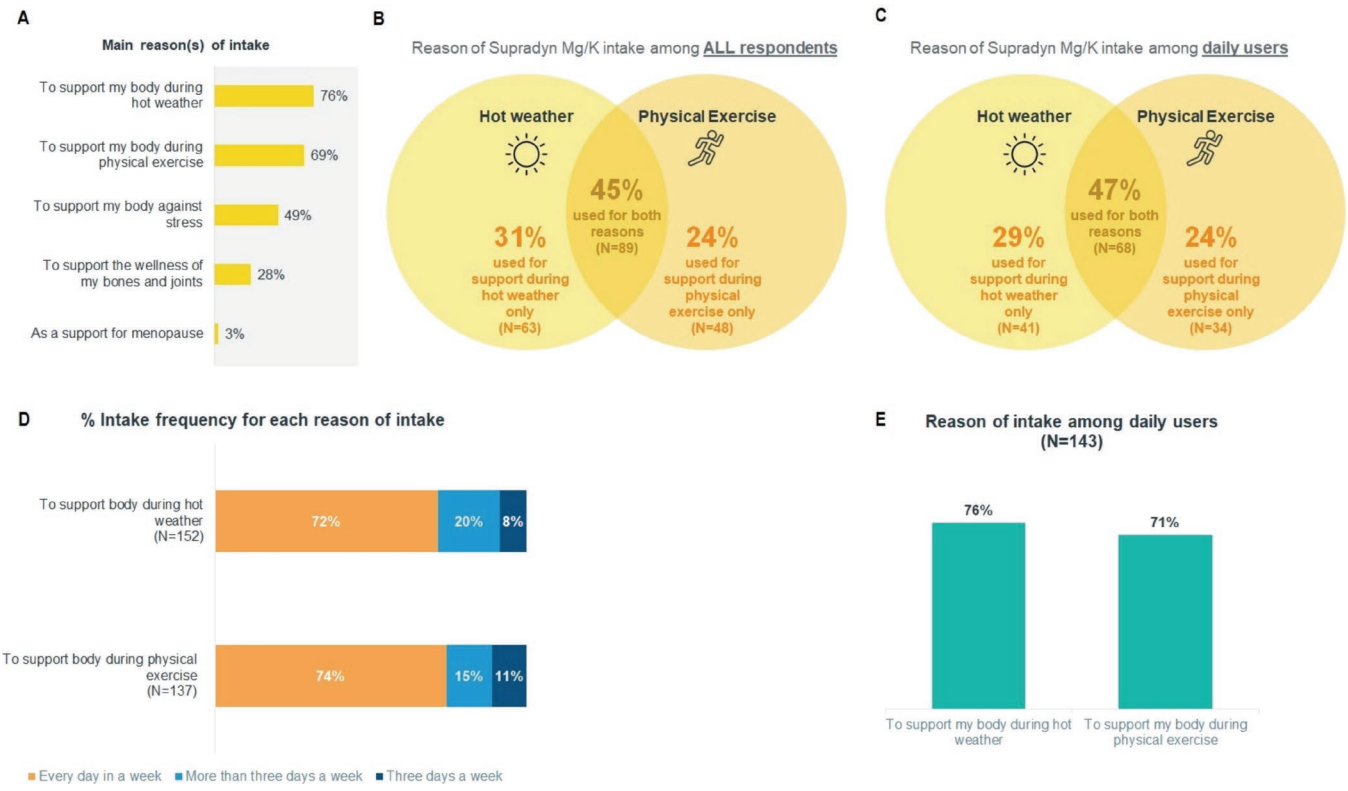
Of the 323 consumers (80%) taking Supradyn Recharge to support lifestyle change, stress resilience or both, ≥84% agreed (i.e. voted somewhat agree/strongly agree) that they feel more energetic and are better able to cope with busy days and weeks, face new challenges in work and personal life, improve their work or study performance, and feel supported against stress. Of the 221 (55%) consumers taking the product for seasonal change support, ≥79% agreed (i.e. voted somewhat agree/strongly agree) that they start the day with greater energy, in a better mood, and wake up motivated, even in periods of seasonal change. Of the 137 (34%) respondents taking Supradyn to support post-illness recovery, ≥79% agreed (i.e. voted somewhat agree/strongly agree) that they could resume their daily routines with energy and return to normal life more quickly than expected after illness (Table 4).

Supradyn Mg/K

Consumption behaviour

The Supradyn Mg/K consumption behaviour of respondents is reported in Figure 1B. Overall, 69% (*n*=138) were repeat users, whilst 31% (*n*=62) were first-time users. The mean time of first use was 1.6 years before the survey, and most respondents (56%, *n*=112) had used the product from 1 to more than 3 years before the survey. The mean time of last use was 0.6 months before the survey, with over half (58%, *n*=116) claiming they were currently using Supradyn Mg/K and only a minority (3%, *n*=5) claiming they had used it more than 4 months before the survey. Overall, 95% (*n*=190) of respondents had used the product continuously for 2 weeks or more in the 6 months before the survey, and 21% (*n*=42) had used it for more than 5 weeks. The average weekly intake frequency was 6 days, with almost three-quarters of respondents (72%, *n*=143) taking Supradyn Mg/K daily. A total of 88% (*n*=176) of users found the taste of Supradyn Mg/K effervescent powder pleasant (i.e. voted pleasant/very

Figure 3. Reasons for intake and intake frequency per reason of Supradyn Magnesium and Potassium. (A, B) Reasons for intake. (C) Reasons for intake amongst daily users. (D) Intake frequency according to reason of intake. (E) Reason for intake amongst daily users.



pleasant), and 85% (*n*=170) agreed (i.e. voted somewhat agree/strongly agree) that the product quenches thirst with a good taste.

Benefits sought, reasons for intake and intake frequency per reason

The respondents' main reasons for Supradyn Mg/K intake included supporting the body during hot weather (76%, *n*=152; of whom 72% took it daily and 20% more than 3 days a week) and during physical exercise (69%, *n*=138; of whom 74% took it daily and 15% more than 3 days a week) (Figure 3A, D). The percentage of consumers using the product as a support for physical exercise was highest amongst men (80%), higher educated users (75%) and daily users (71%). Of all respondents, 31% (*n*=63) used the product only for support during hot weather, 24% (*n*=48) only for support during physical exercise and 45% (*n*=89) for both reasons (Figure 3B). Almost half of the respondents (49%, *n*=98) claimed to be using the product to support the body against stress; other reasons for intake included supporting bone and joint wellness (28%, *n*=56) and supporting the body during menopause (3%, *n*=6). Amongst the 143 (72%) daily users, 29% (*n*=41) used Supradyn Mg/K only for support during hot weather, 24% (*n*=34) only for support during physical exercise and 47% (*n*=68) for both reasons (Figure 3C, E).

Consumer satisfaction

A total of 92% (*n*=184) of users would use Supradyn Mg/K again, 87% (*n*=174) reported QoL improvements since taking the product and 84% (*n*=168) agreed (i.e. voted somewhat agree/strongly agree) on good value for money. Overall, 94% (*n*=188) of all respondents were satisfied (i.e. voted somewhat satisfied/strongly satisfied) with Supradyn Mg/K. In particular, the percentage of respondents claiming they were strongly satisfied was higher amongst daily users (64%) and those with higher/university education and PhD/Master's degree (63%) than the other categories. In general, 95% (*n*=190) would probably or strongly recommend the product to friends and family.

Of the 152 (76%) consumers taking Supradyn Mg/K as a support during the hot season, ≥88% agreed (i.e. voted somewhat agree/strongly agree) that the product is an ally and helps them face the daily routines with energy even on the hottest days, is a concentrate of strength and the preferred way to replenish lost minerals in case

of stuffiness (Table 4). Of the 137 (69%) consumers taking the product to support the body during exercise, ≥80% agreed (i.e. voted somewhat agree/strongly agree) that Supradyn Mg/K is an ally against fatigue, helps them feel energetic and regain energy quicker after a physical performance, is a strength booster and is the preferred way to replenish lost minerals (Table 4).

Discussion

The present study investigated real-world experience and usage of Supradyn Recharge and Supradyn Mg/K of over 600 consumers through online questionnaires, complementing the positive findings from clinical studies.

Overall, there was great satisfaction with both products. More than 9 out of 10 consumers claiming to be satisfied with them, would use them again and would recommend them to friends and family; in addition, over two-thirds felt that they were good value for money. Insights on consumption behaviour of consumers further support this general satisfaction. Most respondents were long-time and daily users, with an average daily intake of 6 days for both products, suggesting their perceived usefulness. Moreover, respondents were satisfied with the taste and convenience of the different product formulations.

Regarding Supradyn Recharge, most consumers reported having a family, a job and a good educational background. Most consumers expressed seeking to boost energy and relieve physical fatigue with the product and were regular users who took the product daily, with the average last use in the month before the survey. Supradyn Recharge has been prominently used for supporting lifestyle changes and mental resilience (8 in 10 users), followed by support for seasonal changes and post-illness recovery. Indeed, statements on 'energy' were particularly agreed upon by the respondents in these three situations, who also reported on the positive impact on QoL and work/study management.

Regarding Supradyn Mg/K, the consumer profile is similar to that of Supradyn Recharge, with the majority being married, employed and with a good educational background. Again, a high percentage (around two-thirds) of respondents were repeat and regular users, with most respondents continuing to take the supplement and around three-quarters of users taking the product daily. Around 7 in 10 users have used Supradyn Mg/K to sustain energy levels during hot weather or to regain energy during physical activity. In addition, half of the respondents said that they use the product to support the body against stress. Indeed, energy support claims in these situations showed strong respondent agreement on all related statements (Table 4) and 8 out of 10 users claimed a positive impact on QoL after usage.

The reasons behind high product usefulness and satisfaction probably rely on the unique composition of Supradyn. Supradyn Recharge has a complete formula, with all 13 vitamins, with high doses of vitamins B1, B2, and B5, niacin (in amounts equal to 300% of the recommended nutrient intake (RNI)), mineral salts, and a CoQ10 source[12] (Table 1), with a demonstrated superior bioavailability.[26] Supradyn Mg/K has a unique formula with high-dosage water-soluble B vitamins and three times the RNI of vitamin C, plus magnesium and potassium (Table 1). It is particularly recommended in physical activity and hot weather, as its formula replenishes magnesium and potassium lost through perspiration, whilst B vitamins and vitamin C help reduce the feeling of tiredness and fatigue. Supradyn Mg/K has been formulated as an effervescent powder to be dissolved in water before ingestion.[13] Thanks to the presence of excess citric acid, the acidic pH value of the solution allows for the complete solubility of the magnesium salt (magnesium oxide) so that it is easily ionized. This is an important prerequisite for the absorption and improved bioavailability of magnesium.[27]

Micronutrients are known to play a role in energy metabolism, brain function (e.g. via receptor binding, membrane ion pump function and neurotransmitter synthesis) and cerebral blood supply regulation.[28,29] Regarding energy metabolism, the majority of the 13 vitamins and several minerals play direct or indirect roles in mitochondrial function.[29–31] B vitamins have essential and widespread functions as coenzymes and precursors in cellular processes. Specifically, vitamins B1, B2, B3 and B5 are crucial cofactors in aerobic mitochondrial respiration (and thus cellular energy production), as they contribute to the tricarboxylic acid cycle, electron transport chain and synthesis of ATP, which is the cell's energy source. Moreover, vitamins B6, B9 and B12 play pivotal roles in all facets of one-carbon metabolism.[29,31–33] Regarding brain function, group B vitamins have vital roles in the synthesis and/or repair of DNA and RNA as well as in the synthesis of various signalling molecules, including neurochemicals.[4] Micronutrients have a significant impact on brain function, with zinc being essential for receptor binding and metalloprotein formation, calcium contributing to signal transduction and membrane potential, and zinc, calcium and magnesium playing crucial roles in neurotransmission.[2]

Similarly, along with vitamins, CoQ10 is a vital coenzyme that is indispensable for the production of ATP in mitochondria through oxidative phosphorylation. It possesses antioxidant properties and aids in the regulation of

reactive oxygen species, reducing oxidative stress.[34,35] CoQ10 is produced endogenously at a low rate but its levels can be increased through dietary sources. Fatigue and various conditions linked to impaired mitochondrial function have been linked to deficiencies in both vitamins B and CoQ10.[4,29,32]

A healthy diet can be difficult to achieve and depends on various social, economic, educational, ethnic and cultural factors.[24,36] Moreover, a large section of the population is unable or unwilling to eat an adequately balanced diet that would satisfy their micronutrient requirements.[6,37] Therefore, sub-optimal micronutrient intake, that is, below the recommended dietary allowance, is surprisingly common, even in industrialized countries.[6,7,36] A survey of the dietary habits of over 36,000 people aged 35–74 years across 10 European countries reported calcium and magnesium intakes below the RNI in several populations, including Italian women.[38] Hypovitaminosis D has long been known to be particularly widespread in Europe, even in southern European countries such as Italy.[39] Two Italian studies on more than 2000 people found potassium, calcium, and vitamin D and E intakes much lower than the RNI in both sexes.[40,41] Finally, another study rated the European iodine status as 'concerning' and advocated for potential solutions such as alternative vehicles.[7] Apart from dietary intake, several other factors can impact the levels of micronutrients in the body. Physical and mental exertion can cause the depletion of multiple micronutrients needed to replenish expended energy. Illness and concomitant drug use can also affect the body's micronutrient stores. Seasonal demands, such as higher mineral requirements in the summer, can also have an impact. Sex-specific factors like menstruation can lead to low iron levels and reports of tiredness in women.[3,42] For example, an Italian sample of healthy blood donors showed that adequate vitamin B12 concentration is achieved in only a limited percentage of participants, encouraging consideration of specific public health strategies.[43] Ideally, a balanced and sufficient diet should cover daily micronutrient requirements. Although only 2% of respondents to the Supradyn Recharge questionnaire indicated that their diet is balanced, many stated that they eat at least two portions of fruit and vegetables a day and follow no particular dietary restrictions (only ~2% were vegan/vegetarian). Therefore, even in the case of a complete diet, there may be demanding and challenging periods when supplemental micronutrient intake could help such as when exposed to pathogens or falling ill, when requiring extra energy during or after physical/mental activities, and when facing behavioural changes due to seasonal changes. In all of these circumstances, micronutrients play a crucial role in sustaining the biological processes that aid in preserving and re-establishing homeostasis in the body and enabling adequate responses to stressors that may threaten it.[3] Indeed, depletion of both B vitamins and CoQ10 is associated with fatigue and several conditions related to mitochondrial dysfunction.[2,4,23,44,45] In this perspective, fatigue may represent the clinical alert launched by the organism with limited homeostatic capacity in front of a disproportionate stressor challenging it.[11,46] Moreover, healthcare professionals typically underestimate fatigue, which often remains an unexplained symptom with unclear pathophysiological mechanisms.[9] Since fatigue mirrors the depletion of an individual's physiological reserves,[11] there is a strong rationale for the use of a supplement containing a combination of micronutrients, particularly B vitamins, mineral salts and CoQ10, to improve energy levels,[24] especially in demanding times such as stressful periods, physical activities, seasonal changes and post-illness recovery (Table 4).[3] Therefore, chronic and acute supplementation with multivitamins/minerals is useful to support improved performance of cognitive tasks, psychological state, or assessment of physical and mental tiredness in healthy male and female adults, as demonstrated by previous observational and randomized blinded controlled trials.[4,14–23]

Finally, over the years several authorities have reviewed the safety of vitamins and minerals and, in some instances, have set a tolerable upper intake level, which is the highest level of daily intake of a specific micronutrient that is likely to pose no risk of adverse health effects in humans.[47–51] The content of the micronutrients in the Supradyn products is well below the tolerable upper intake level; therefore, the products are regarded as safe and suited for chronic use.

The strengths of this study comprise the large sample size and the fact that it provides a real-world picture of how and why Supradyn formulations are used as well as their perceived benefits. This is particularly important as participant-reported outcomes are not usually investigated in clinical trials and are becoming increasingly important to complete the normally assessed clinical outcomes. Moreover, participants included in clinical trials are a selected population and do not always represent the overall population; on the other end, observational studies generate data from a representative population. As the survey respondents had bought and taken Supradyn in the past 6 months, the self-reported results of this study may be considered neutral. The study's limitations include those typical of real-world investigations where retrospective information is gathered via an online questionnaire. Data cannot be monitored in this setting and may be subject to recall bias.[52] The inclusion criteria were designed to limit participants to those who had used Supradyn in the 6 months before the study, as a 6-month period was considered enough

to diminish recall bias and provide precise and reliable data. Moreover, quality check questions were built into the questionnaire to identify recall bias. Lastly, whilst the survey questions were not officially validated, their method of administration (e.g. by providing respondents with categorical answers and Likert-type scale options) has been utilized and examined for its robustness and consistency in other comparable studies in the past years.[53,54]

Conclusion

The present survey allowed us to explore consumer behaviour and satisfaction with the multivitamin and mineral supplements Supradyn Recharge and Supradyn Mg/K. For both supplements, most respondents were middle-aged, with a job, a family and higher education. Overall, the perception of benefit by consumers was extremely positive, with 90% claiming that they were satisfied, would use them again and recommend them to family and friends. Additionally, consumers appreciated the supplement's taste and way of intake. The consumption behaviour of consumers reflected this overall satisfaction. The majority stated to be long time and daily users and had an average daily intake of 6 days for both products, suggesting their perceived usefulness. These data complement and add up to the positive findings of clinical trials with Supradyn.[4,21–23]

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Correspondence: Barbara Moroni, Bayer S.p.A., viale Certosa 130, 20156 Milano (MI), Italia. Email: barbara.moroni@bayer.com

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