

The Mediterranean Diet: From Intention to Behavior the Role of Multidimensional Perceived Social Support (MPSS)

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Abstract

The process of grinding spices is an essential step in the food industry since it has a direct impact on the quality, flavor, and functional qualities of spice powders. Because of the increasing demand on a global scale, ensuring that grinding is both efficient and of good quality has become a priority. In this paper, a detailed overview of traditional and modern methods for grinding spices is provided. The analysis highlights the advantages and drawbacks of each approach, as well as essential operating parameters such as temperature, moisture content, and particle size used in the grinding process. Key issues, such as the formation of heat, the loss of nutrients, the risk of contamination, and the high consumption of energy, are investigated, along with the impact that these challenges have on the efficiency of grinding and the quality of the result. Technology advancements, such as cryogenic grinding, superfine grinding, and automation through the use of artificial intelligence and the internet of things, have been essential in solving some of these challenges while also introducing techniques that are sustainable and favorable to the environment. In the final section of the review, we will analyze the ongoing difficulties, the possibilities for the future, and the possibility of developing novel solutions to make the process of grinding spices more effective, environmentally friendly, and quality-oriented.

Keywords

Advanced Grinding Technologies, Challenges, Cryogenic Grinding, Spice Grinding, Superfine Grinding

INTRODUCTION

The Mediterranean diet (MD) reflects the foods consumed, eating practices, and cultural heritage of populations living in the Mediterranean region [1][2][3]. Accordingly, the MD is regarded not only as a dietary pattern but also as a lifestyle [1][2][4][5]. Nevertheless, recent work shows that adherence to health-promoting diets such as the MD—together with regular physical activity—remains lower than expected, particularly among younger groups [6][7][8][9][10][11][12]. Among adults, common barriers to integrating the MD into daily life include cost, limited time for cooking, and insufficient knowledge [13][14][15]. The literature points to several levers for improving adoption: strengthening self-efficacy and related TPB determinants [16], developing practical cooking skills [17], and providing structured, MD-focused education and behavior-change supports [18]. Emotional and peer support can also help individuals initiate and sustain dietary change, while social capital is associated with better diet quality [19][20]. Similar barriers and needs have been reported in non-Mediterranean populations, underscoring the broader relevance of these challenges and supports [14][15][21][22]. Overall, converging evidence indicates that social support—often via its links to diet self-efficacy—plays a key role in initiating and maintaining adherence [19][23][24]. In addition, international food-safety and knowledge-sharing networks (e.g., INFOSAN) indirectly facilitate the diffusion of healthier eating patterns such as the

MD [25].

Despite Turkey's rich food diversity, local products, and traditional foods, adherence to the MD appears suboptimal. For example, university-student samples report modest adherence or low diet quality [26][27][28][29]; in clinical and community contexts, lower MD adherence has been linked with higher diabetes risk and other adverse outcomes [30][31][32]. Regionally, adherence can vary even within Mediterranean countries; adolescents in southern Italy adhere to the MD more than those in northern regions [33]. Given these gaps in a Mediterranean country such as the Republic of Turkey, social support is likely to play a critical role in adherence and maintenance. The present study therefore examines whether multidimensional perceived social support moderates the translation of intention into behavior regarding the MD in seven of Turkey's most populous provinces (İstanbul, Ankara, İzmir, Bursa, Antalya, Muğla, and Aydın). To this end, we propose a six-construct model grounded in the Theory of Planned Behavior, augmented with multidimensional perceived social support and a behavioral (action) component.

CONCEPTUAL FRAMEWORK

The Mediterranean diet (MD) traces back to foodways practiced for millennia by peoples of the Mediterranean basin, with roots in classical Greco-Roman cultures and earlier regional traditions [1][2][34][35]. The dietary guidance emphasized by the ancient Greek philosopher

Plato—moderation with legumes, fruits, milk, honey, and fish—shows striking similarities to the MD [32]. The conquests of Alexander the Great helped disseminate MD-like practices, while contact with diverse geographies further shaped the pattern over time [34][35]. During the Roman–Byzantine period (2nd–9th centuries), consumption profiles consistent with an MD pattern are documented in Anatolia [36]. In subsequent centuries, the Seljuks (11th–13th centuries), who adopted a settled agrarian lifestyle in Anatolia, produced and consumed vegetables, fruits, legumes, honey, milk, and dairy products [37]. Throughout the Ottoman periods, dietary habits resembling the MD persisted across Anatolian lands [38]. Political transformations, urbanization, and technological change altered everyday eating patterns [35][37]. These shifts are particularly visible in diets—such as the MD—that foreground local ingredients and traditional rituals [1][2][34]. The evolution of MD-related eating practices over time is illustrated in Figure 1.

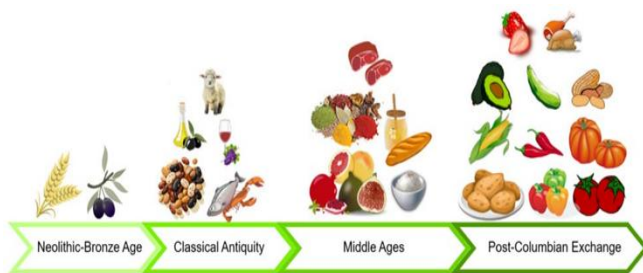


Fig. 1. Historical evolution of Mediterranean diet eating practices [16].

The MD is a dietary pattern observed across the Mediterranean basin—from Southern Europe to North Africa and the Levant [1][2][3]. Although regional variations exist, its core includes daily consumption of vegetables, fruits, olive oil, whole grains, dairy products, and nuts/seeds [1, 4]. Weekly foods emphasize legumes, fish, potatoes, and whole grains, while cakes and sweets are recommended only occasionally [1]. Thanks to its diversity and food quality, the MD helps reduce oxidative stress and low-grade inflammation and is associated with protection against cardiometabolic and other chronic diseases [30][35][39]. Beyond ingredients alone, traditional cooking techniques—particularly the use of olive oil during preparation—also support healthier cooking [30][40]. The health impacts of the MD are summarized in Figure 2.

The MD ranks among the healthiest dietary patterns worldwide [4][40][41]. The term “Mediterranean” reflects foods traditionally grown and eaten by local populations across the region [2][3][42]. In this context, residents characteristically consume locally produced, seasonal foods—“from farm to table”—prepared with culturally embedded methods [1][2][3]. Core components include fruits and vegetables, whole grains, healthy fats (notably olive oil), legumes, nuts, and seeds [1][4]. Distinctive methods such as shallow frying in olive oil are common [30][40]. Overall, the MD represents a holistic lifestyle that encourages physical

activity, emphasizes seasonal and local foods, and values culinary rituals; in doing so, it supports sustainability and biodiversity goals [2][3][4][35]. UNESCO describes the MD as a living body of knowledge transmitted across generations and inscribed it on the Representative List of the Intangible Cultural Heritage of Humanity in 2010 (led by Spain, Greece, Italy, and Morocco), with expanded documentation in 2013 [2][3].

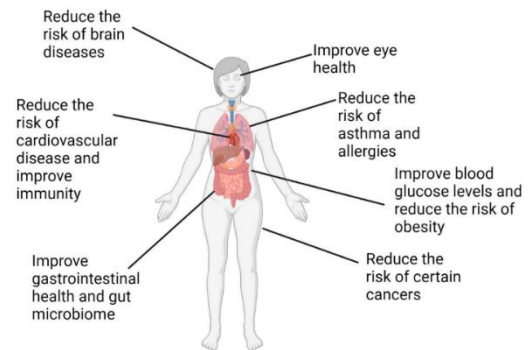


Fig. 2. Health impacts of the Mediterranean diet [35].

METHODS

Sample

A quantitative, cross-sectional design was used to enable a large sample. Participants were recruited via non-probability convenience sampling and classified into two groups: those who reported practicing the Mediterranean Diet and those who did not. Convenience sampling involves enrolling individuals who meet the study aims and are readily accessible to the researcher [43]. To enhance population coverage, data were collected in seven of Türkiye’s most populous provinces—Istanbul, Ankara, İzmir, Bursa, Antalya, Muğla, and Aydın—yielding $n=391$ respondents.

Data Collection

Data were gathered using a self-administered online questionnaire with five-point Likert-type items. Intention toward the Mediterranean Diet and its Theory of Planned Behavior (TPB) antecedents—attitude, subjective norm, perceived behavioral control—were adapted from Bélanger et al. (2023) [16]. Perceived social support was measured with the Multidimensional Scale of Perceived Social Support (MSPSS) using items adapted from Zhang et al. (2021) [44]. The full instrument underwent expert review by four domain specialists; items were translated from English to Turkish and back-translated, with wording refined to ensure semantic equivalence and alignment with the study aims.

H1: As attitudes toward the Mediterranean diet become more favorable, behavioral intention increases.

H2: As perceived subjective norm increases, behavioral intention increases.

H3: As perceived behavioral control increases, behavioral intention increases.

H4: Individuals with higher behavioral intention are more likely to practice the Mediterranean diet.

H5: As perceived social support increases, attitude, subjective norm, and perceived behavioral control are strengthened, thereby increasing behavioral intention.

Statistical Analysis

The data were analyzed in SPSS. Simple descriptive statistics counts, percentages, means, and standard deviations were computed to summarize the sample and scale scores. Next, data suitability for parametric analyses was evaluated via the Shapiro–Wilk test of normality alongside inspection of skewness and kurtosis. Pearson correlations were then used to examine associations among the variables. Finally, independent-samples *t* tests assessed whether scores differed between participants who reported following the Mediterranean diet and those who did not.

RESULTS

The distribution of participants' demographic characteristics is presented in detail in Table 1.

Table 1. The distribution of participants' demographic characteristics values

Participant Characteristics		n	%
Gender	Man	197	50.4
	Woman	194	49.6
Age	18–29	188	48.1
	30–50	203	51.9
	51–70	0	0
	70+	0	0
Education	Primary school	15	3.8
	Middle school	35	9
	High school	104	26.6
	Associate degree	137	35
	Bachelor's degree	100	25.6
	Postgraduate	0	0
Marital Status	Married	198	50.6
	Single	193	49.4
People on a diet	Yes	260	66.5
	No	131	33.5
Those Who Have Done/Will Do the Mediterranean Diet	Yes	296	75.7
	No	95	24.3
Those Who Know About the Mediterranean Diet	Yes	295	75.4
	No	96	24.6

The gender distribution of participants was fairly balanced. The age range clustered in young and middle adulthood. In terms of education, the most frequent levels were associate degree (35%), high school (26.6%), and then bachelor's degree (25.6%). Marital status was also balanced (married 52.3%, single 47.8%). Overall, 66.5% of participants reported having dieted at least once in their lifetime. Similarly, those who had followed or intended to follow the Mediterranean Diet constituted the majority (75.7%). The proportion who reported knowledge about the Mediterranean Diet was

75.4%, closely mirroring the “have done/will do” group. To inform subsequent analyses, normality was assessed: the Shapiro–Wilk test indicated deviations from normality at $p < .05$ ($W = .818-.972$, $n = 391$). Skewness and kurtosis values for the study scales are provided in Table 2.

Table 2. Skewness and kurtosis values

Variables	n	Av.	SS	Skewness (SH)	Kurtosis (SH)
Multidimensional Perceived Social Support	391	3.820	0.570	-0.830 (0.123)	0.280 (0.250)
Behavioral Intention	391	4.097	0.717	-0.355 (0.123)	-0.335 (0.246)
Perceived Behavioral Control	391	3.751	0.728	-0.155 (0.123)	-0.661 (0.246)
Subjective Norm	391	3.428	1.025	-0.391 (0.123)	-0.473 (0.246)
Attitude	391	3.889	0.692	-0.751 (0.123)	0.912 (0.246)

Skewness and kurtosis for all scale dimensions fell within ± 2 , indicating approximate normality. Accordingly, we proceeded with parametric analyses for these variables. Bivariate associations were estimated using Pearson's product–moment correlations, and the corresponding coefficients are reported in Table 3.

Increases in Multidimensional Perceived Social Support (family, friends, significant other) were associated with higher perceived behavioral control, behavioral intention, and attitude toward the Mediterranean Diet ($r \approx .10-.18$, $p < .05/.01$). The most pronounced linkage was between perceived behavioral control and subjective norm ($r = .565$, $p < .001$); both also showed moderate correlations with attitude (PBC–Attitude $r = .344$; SN–Attitude $r = .346$, $p < .001$). Behavioral intention displayed weak but statistically significant correlations with MSPSS, subjective norm, and perceived behavioral control ($r \approx .10-.13$, $p < .05$). Overall, all associations were positive and mostly small to moderate in magnitude. To examine mean differences, independent-samples *t*-tests compared respondents who had ever followed or intended to follow the Mediterranean Diet with those who had not; detailed statistics are reported in Table 4.

Independent-samples *t*-tests comparing those who had followed/intended to follow the Mediterranean Diet (yes, $n = 296$) with those who had not (no, $n = 95$) indicated no statistically significant mean differences across the five constructs. For example, MSPSS was 3.81 in the “yes” group versus 3.86 in the “no” group, $t(389) = -0.70$, $p = .487$, $\eta^2 = .001$. Behavioral intention was 4.12 vs. 4.02, $t(389) = 1.19$, $p = .234$, $\eta^2 = .004$. Perceived behavioral control was 3.78 vs. 3.67, $t(389) = 1.27$, $p = .206$, $\eta^2 = .004$. Subjective norm was 3.46 vs. 3.33, $t(389) = 1.12$, $p = .265$, $\eta^2 = .003$; and attitude was 3.93 vs. 3.78, $t(389) = 1.85$, $p = .066$, $\eta^2 = .009$. Although group means tended to be slightly higher among those reporting MD engagement, the effect sizes were uniformly small.

Table 3. Pearson's product-moment correlations, and the corresponding coefficients values

		Multidimensional Perceived Social Support	Behavioral Intention	Perceived Behavioral Control	Subjective Norm	Attitude
c	Pearson Correlation	-	.133**	.180**	.101*	.168**
	Sig. (2-tailed)		0.009	<.001	0.046	<.001
	N		391	391	391	391
Behavioral Intention	Pearson Correlation		-	.104*	.106*	0.089
	Sig. (2-tailed)			0.039	0.037	0.079
	N			391	391	391
Perceived Behavioral Control	Pearson Correlation			-	.565**	.344**
	Sig. (2-tailed)				<.001	<.001
	N				391	391
Subjective Norm	Pearson Correlation				-	.346**
	Sig. (2-tailed)					<.001
	N					391
Attitude	Pearson Correlation					-
	Sig. (2-tailed)					
	N					

Table 4. independent-samples t-tests values

Variables	Group	N	\bar{X}	Ss	t	sd	p	η^2
Multidimensional Perceived Social Support	Yes	296	3.81	0.57	-0.70	389	0.487	0.001
	No	95	3.86	0.58				
Behavioral Intention	Yes	296	4.12	0.7	1.19	389	0.234	0.004
	No	95	4.02	0.76				
Perceived Behavioral Control	Yes	296	3.78	0.72	1.27	389	0.206	0.004
	No	95	3.67	0.76				
Subjective Norm	Yes	296	3.46	1.01	1.12	389	0.265	0.003
	No	95	3.33	1.06				
Attitude	Yes	296	3.93	0.69	1.85	389	0.066	0.009
	No	95	3.78	0.69				

DISCUSSION

In this study examining how intention toward the Mediterranean Diet (MD) translates into behavior through the lenses of the Theory of Planned Behavior (TPB) and Multidimensional Perceived Social Support (MPSS), data from 391 participants showed mostly positive, small-to-moderate associations among psychosocial determinants. As MPSS increased, perceived behavioral control (PBC), behavioral intention, and attitudes also increased ($r \approx .10-.18$). The strongest association was between PBC and subjective norm (SN) ($r=.565$), and both correlated moderately with attitude (PBC-Attitude $r=.344$; SN-Attitude $r=.346$). By contrast, independent-samples t-tests comparing those who had ever practiced the MD with those who had not indicated no statistically significant differences across the five constructs (all $ps>.05$; $\eta^2=.001-.009$; small effects). Overall, the findings are consistent with TPB: SN and PBC relate positively to attitude and intention, with the SN-PBC link being the strongest ($r=.565$), in line with prior diet-

related TPB research (e.g., [16][18][45][46][47][48]). The MPSS associations with intention/PBC/attitude were small ($r\approx.10-.13$), suggesting that general social support may influence MD behavior via indirect pathways, whereas behavior-specific (instrumental) support could be more decisive. Recent evidence likewise indicates that intention is central for behavior change, yet short-term changes can remain limited—consistent with the small group differences observed here [18][49]. Strengthening SN and PBC alongside enhancing behavior-specific support may facilitate the translation of favorable intentions and attitudes toward the MD into consistent dietary behavior [16][18][38][46].

A study using a peer-support approach to dietary change showed that when social supports (e.g., family/friend approval and ongoing encouragement) strengthen subjective-norm components, healthy choices become more likely [23]. This aligns with the MPSS-SN-PBC pattern observed in our data. The small associations found between perceived social support and intention/PBC/attitude may depend on how—and for how long—support is provided. In a clinical context, after

12 weeks of nutrition counseling, perceived social support and self-control increased while depression decreased, indicating that sustained, structured support can lay a foundation for behavior change [50]. Moreover, when goal-specific support and psychological resources are engaged, dietary adherence becomes even more evident: among individuals with celiac disease, higher perceived social support and psychological resilience were associated with greater adherence to a gluten-free diet and lower symptom severity [51]. Although this evidence comes from a gluten-free context, it underscores the pivotal role of social support in facilitating diet adherence.

Across the literature, groups adhering to the MD consistently outperform non-adherent groups on objective outcomes. For example, individuals following a high-polyphenol Mediterranean diet showed significant and sustained reductions in visceral adiposity in the DIRECT-PLUS trial [52]. Similarly, among MD-adherent groups, morning fasting cortisol declined over an 18-month period, with reported metabolic improvements [4]. In another randomized clinical trial (~8 months), MD participants achieved greater loss of body weight and visceral fat than control participants, indicating that differences emerge particularly on somatic/physiological endpoints in the short to mid-term [53]. Household context also matters: as mothers' MD adherence increases, children's adherence and dietary diversity rise, highlighting the practical influence of social support and suggesting that adherent groups may be more effectively supported by family/environmental factors [28][54]. Finally, cognitive-emotional labeling helps distinguish "dieters" from "non-dieters," implying that even when differences in attitude, intention, and perceived control are small, adherent and non-adherent groups can still be differentiated [55].

CONCLUSION

The most notable findings are the strong positive association between Subjective Norm (SN) and Perceived Behavioral Control (PBC) ($r=.565$) and the moderate associations of both constructs with attitude. This pattern indicates that when perceived social approval and the "I can do this" appraisal strengthen together, favorable evaluations of—and intentions toward—the Mediterranean Diet (MD) are reinforced.

The correlations between Multidimensional Perceived Social Support (MPSS) and intention, attitude, and PBC are small ($r\approx.10-.18$). This suggests that social support, on its own, may not be a powerful driver; rather, when combined with regular, behavior-specific support, it may facilitate the translation of intention into action. Although the impact of support can appear weak in the short term, its behavioral imprint likely grows with continuity and goal specificity.

The absence of significant differences across the five psychosocial constructs between MD adopters and non-adopters ($p > .05$; $\eta^2 = .001-.009$) invites two complementary interpretations. First, despite similar cognitive and social

determinants, practical barriers—cost, time, meal-preparation skills, and access—may remain persistent obstacles to behavior. Second, defining behavior broadly (e.g., having tried the MD at least once in the past) may mask differences in recent and sustained adherence. Accordingly, future work should employ sharper behavioral criteria that capture recent (e.g., last 1–3 months) and regular adherence, ideally indexed by an intensity-sensitive Mediterranean Diet Score.

In sum, this study indicates that intention toward the Mediterranean Diet (MD) is not sufficient on its own; translating intention into behavior requires the joint action of perceived social approval, a strong sense of "I can do this" (perceived behavioral control), and sustained, MD-specific social support. To strengthen self-efficacy and make the MD more actionable, targeted education, hands-on workshops, and broader community awareness efforts are recommended.

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