Original Article

Bayesian network analysis of sensory profiles with coping styles, psychopathology, and sleep disorders in young adults

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SUMMARY

Background

Sensory processing has a significant impact on the individual's quality of life. This study explores the relationship between sensory profiles in typically developed adults and their associations with psychopathology, sleep, and coping abilities.

Methods

A total of 508 adults (54.7% female, 45.3% male; mean age 27.68 years) were assessed using the Adolescent/Adult Sensory Profile, DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure-Adult, SLEEP-50 questionnaire, and Brief-COPE. Bayesian Network analyses were employed to estimate associations between sensory profiles, psychopathology symptoms, sleep disorders, and coping abilities.

Results

Positive associations were found between sensation seeking and coping, as well as mania. Sensation avoiding correlated positively with insomnia and coping. Sensation seeking was associated with emotion-focused coping, while sensation avoiding was mainly related to maladaptive coping styles.

Conclusion

Our study highlights the importance of sensory profiles in the mental well-being of young adults, indicating specific associations with mental disorders, sleep issues, and coping strategies. These insights can inform targeted interventions to enhance overall mental health.

Key words: sensory profile, network analysis, sensation seeking, coping, psychopathology, sleep disorders

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How to cite this article: Amore M, Escelsior A, Marchi C, et al. Bayesian network analysis of sensory profiles with coping styles, psychopathology, and sleep disorders in young adults. Journal of Psychopathology 2026;32:5-16. https://doi.org/10.36148/2284-0249-1950

Introduction

Sensory processing

Sensory processing refers to the complex neurobiological process through which the central and peripheral nervous systems detect and interpret incoming sensory information from the environment. It involves various sensory systems, including hearing, sight, smell, taste, touch-pressure, proprioception, thermoception, balance, and pain sensation, that allow individuals to perceive, adapt to, and interact with their environment [1]. Research reveals how internal and external factors shape sensory pro-

cessing [2]. Each person has a unique sensory threshold that affects how they perceive and respond to input, with important implications for temperament, mood, behavior, and decision-making [3]. Jean Ayres, an occupational therapist, introduced the concept of sensory integration, defining it as the neurological process by which the brain organizes sensory inputs to generate appropriate and adaptive responses. This internal organization supports not only perception but also motor coordination and self-regulation [4,5]. Ayres emphasized that sensory integration forms the basis of how individuals engage with their environment and develop adaptive behavior. Ayres described sensory integration as crucial for adaptive behavior and environmental interaction, distinguishing sensory perception - linked to cognition and purposeful action - from sensory modulation, which regulates attention, arousal, activity, and emotion. She also associated somatosensory perception with practical functioning [6]. The Ayres intervention leverages neuroplasticity, using sensory, motor, and cognitive challenges to induce changes in the nervous system, such as increased grey matter, angiogenesis, glial growth, and neurogenesis [7]. Reynolds, Lane and Richards [8] studied these effects in animal models. Ayres' key insight was linking experiential interventions - based on individualized sensorimotor activities - to neuroplasticity, leading to changes in function and behaviour. Sensory processing disorders (SPDs), also termed sensory integrative difficulties, encompass deficits in sensory perception, sensory–motor integration, and the regulation of sensory reactivity [1,4]. SPDs can manifest as hypersensitivity or hyposensitivity to stimuli, representing opposing directions [3]. Hypersensitivity refers to a negative reaction to typically harmless sensory inputs, while hyposensitivity involves decreased sensitivity to environmental stimuli [9]. These conditions are not separate phenomena [10] but exist on a continuum and can coexist within an individual across different sensory systems [11]. For instance, someone may exhibit hypersensitivity to touch but demonstrate hyposensitivity to olfactory or taste stimuli. Understanding these variations in sensory processing is crucial for comprehending individual responses to the sensory environment and tailoring interventions accordingly. These disruptions in sensory processing can significantly affect occupational performance, limiting an individual's ability to engage effectively in daily activities such as self-care, learning, play, and social participation [12].

Dunn's Four Quadrant Model of Sensory Processing

Within this context, occupational therapy (OT) plays a central role in assessing and addressing sensory processing differences. A foundational framework widely used in OT is Dunn's Four Quadrant Model of Sensory Processing, developed to interpret how individuals manage sensory input in daily life [3]. This subject was initially explored in relation to children's behavior, with an emphasis on understanding the link between sensory processing and various disabilities, including learning, developmental, and emotional challenges [3]. Dunn's model is based on two key concepts: the neurological threshold, which indicates how much sensory input is needed to trigger a response, and the behavioral response, or how individuals manage sensory input. The neurological threshold exists on a continuum from low (high sensitivity to stimuli) to high (low sensitivity, requiring stronger input). Understanding where a person falls on this spectrum helps guide personalized interventions [13]. The model identifies four distinct sensory profiles:

Low registration: This group exhibits high thresholds and passive responding. They may struggle to express emotions and have a slower response to sensory input. They are often perceived as calm, submissive, and less interested in seeking out stimulating sensations [3,11]. For example, they may show a lack of response to accidents, wounds, or unusual temperatures [10].

Sensation seeking: These individuals have high thresholds but exhibit active responding. They derive pleasure from rich sensory environments and constantly seek out sensory experiences. Others may view them as impulsive and prone to engaging in risky behavior due to a tendency to become easily bored. They may prefer spicy food and loud noises [10].

Sensory sensitivity: This group has low thresholds and reacts strongly to sensory stimuli [10]. They may experience distractibility and discomfort in response to sensory input. Despite this, they do not actively avoid exposure to uncomfortable situations [13].

Sensation avoiding: Individuals in this group have low thresholds and actively respond by limiting exposure to stimuli. They tend to avoid settings that are distracting or overwhelming. Intense and invasive sensory stimulation can evoke negative and aggressive responses from them [10]. Unlike those with sensation seeking patterns who actively seek out stimuli, they tend to retreat from sensory input.

A thorough understanding of adult sensory processing patterns is essential because it allows for the development of personalized interventions that promote emotional regulation, daily functioning, and engagement in meaningful activities, thereby improving occupational performance [3,10,11,13].

Sensory profiles, psychopathology, coping mechanisms, and sleep disorders

Sensory profiles and psychopathology

SPDs can cause impairments in individuals' ability to control and react to sensory information, leading to maladaptive patterns [10,14]. These difficulties can persist into

adulthood and have negative effects on behavior, functioning, and overall well-being [10]. Most literature focuses on SPDs in neurodevelopmental disorders like ADHD and autism, which display distinct sensory processing patterns compared to neurotypical individuals [3]. Recent literature has established connections between SPDs and mental health issues like anxiety, mood disorders, and psychotic disorders. [15]. These correlations have a significant impact on the individual's quality of life as well as their family dynamics [14,16,17]. A meta-analysis of 33 studies on sensory processing difficulties in psychiatric disorders revealed distinct patterns among patients with serious mental illness, highlighting the correlations between low registration, sensory sensitivity, and sensation avoiding [17]. Anxiety and sensory reactivity are related in healthy adults, with high anxiety levels associated with sensory hypersensitivity and low registration of sensory input. Engel-Yeger emphasized the relationship between anxiety and deficits in sensory processing [18]. Anxiety is closely linked to sensory sensitivity and avoiding, both of which are low neurological threshold patterns. Individuals with sensory hypersensitivity may defensively respond to unpleasant sensations due to anxiety, leading to poor self-control [18]. SPDs and post-traumatic stress disorder share common traits such as increased sensory response, negative affect, and behavioral issues. Abnormal regulation of stress systems, involving the ascendant reticular activating system, amygdala, hypothalamus, and prefrontal cortex, may contribute to the pathophysiology of both conditions [18,19]. Depression was significantly correlated with extreme sensory processing patterns, particularly low registration. Both hyposensitivity and hypersensitivity have the potential to intensify negative emotions, thus linking them to depression [20]. In individuals at high risk for developing psychotic illness, SPDs may precede the onset of psychosis. Sensory profiles including very low registration, increased sensory sensitivity, elevated sensation avoiding, and decreased sensation seeking may serve as early markers for psychiatric disorders.

Sensory profiles and coping mechanisms

Identifying individuals' sensory traits can inform personalized interventions to reduce stress and improve quality of life [16]. Notably, available results indicate that sensation seeking has been associated with protective and resilient features for psychiatric disorders, although this profile decreases significantly in older individuals above 65 years old. Reduced sensation seeking in this population may contribute to decreased in daily functioning, social engagement, and community interaction, potentially leading to depression, cognitive deterioration, and consequently in physical wellness [17,21].
Research by Meredith [22] highlights that sensory sensitivity and sensation avoiding profiles are associated with heightened stress and reduced effective coping. This is attributed to an increased tendency to expect negative consequences. In contrast, sensation seeking, which involves a desire for varied and novel sensory experiences, is linked to more active coping strategies, such as using coping self-statements. These self-statements are affirmations or rationalizations individuals use to manage stress, reflecting a proactive approach to dealing with sensory challenges. Building on this, Meredith [23] suggest that active coping strategies tailored to manage sensory sensitivities can substantially reduce distress in healthy adults. By actively engaging in coping behaviors, individuals can mitigate the adverse effects of their sensory processing patterns, thereby improving their well-being. Both sensory processing patterns and coping strategies independently impact quality of life. This indicates that how we process sensory information and the strategies we employ to manage stress are crucial components of our overall well-being [24].

Sensory profiles and sleep disorders

Sleep is a critical occupation for adequate neural function and maturation. Inadequate sleep has been linked to disruptions in attention, memory, mood, and behavior [25]. The most often reported sleep concerns include reduced total sleep time, prolonged sleep latency, poor sleep efficiency, and wake after sleep onset. Sleep has the important function of being a restorative occupation, as widely recognized within the theories of occupational therapies, which promotes refreshment and consequently supports in individuals the daytime occupational aspects of work, free time, and personal care. Some studies describe the existence of a fundamental balance, defined as occupational balance, in which the use of time is studied to understand how the relationship between sleep or rest occupational activity and the typical occupational activity of the day promotes, if well balanced, the well-being and functioning. It is known that an imbalance between restful sleep and daytime activities can lead to an occupational imbalance [26,27].
Available studies suggest that sensory processing patterns can impact on sleep quality, particularly in individuals with low neurological thresholds [28], due to the difficulties to filter out irrelevant stimuli during the pre-sleep wake period [29]. In fact, poor sleepers have been found to exhibit deficits in gating auditory stimuli, including reduced amplitude of the P50 component prior to sleep onset and impaired inhibition and hyperarousal during wakefulness before sleep [28,29,30]. A more recent study of Engel-Yeger and Shochat involving 185 participants aged 21 to 60 years old, further confirm a significant correlation between poorer sleep quality and extreme sensory processing patterns characterized by a low neurological threshold, specifically sensory hypersensitivity, and sensation avoidance [31].

Aims of the study

This study investigates the relationship between sensory profiles and mental health in typically developed adults. Specifically, it examines how Dunn's four-quadrant model of sensory processing relates to psychopathological symptoms, sleep disorders, and coping strategies. To capture these dimensions, the DSM-5 Cross-Cutting Symptoms tool, the SLEEP-50 questionnaire, and the Brief-COPE were used. The goal is to clarify the links between sensory processing, mental well-being, and coping, providing insights useful for interventions in Occupational Therapy.

Material and methods

Study Design

This cross-sectional study employed anonymous questionnaires to gather data from a voluntary sample of the general population. Participants were recruited through public advertisements in various community channels. Convenience sampling was used to target a diverse adult population. The study design was informed by established methodologies in survey administration and sensory processing research [15]. The collected data was utilized to construct a graphical network of the study results.

Participants

The sample was mainly drawn from university students and their acquaintances. Inclusion criteria encompassed individuals over 18 years of age, willing to participate, and proficient in the Italian language. Exclusion criteria involved refusal of informed consent and a diagnosis of major psychiatric disorders. Participants pro-vided informed consent voluntarily after receiving a comprehensive explanation of the study's procedures and objectives. There were no associated risks, and participants did not receive any compensation for their participation. Withdrawal from the study was possible at any point. The dissemination of results will be completely anonymous. The study was conducted in accordance with the Declaration of Helsinki.

Questionnaires

The Adolescent/Adult Sensory Profile

Reactivity and responsiveness patterns in sensory processing tend to remain constant throughout an individual's lifetime, influencing how they learn from every experience, so the Adolescent/Adult Sensory Profile (AASP) allows the examination of sensory reactivity patterns across the lifespan, aiding research, and practice [3]. The AASP is a instrument based on the Dunn's Four Quadrant Model of sensory processing. It consists of a 60-item scale, with 15 items corresponding to each sensory profile, assessing taste/smell, movement, vision, touch, activity level, and auditory processing. The scale measures responses to sensory events using a 5-point Likert scale and the total subscale score are calculated by summing the item scores. Originally developed for children, the AASP covers a full age span. It enhances awareness and understanding of sensory processing preferences for individuals and those close to them. The AASP also assesses the neurological threshold continuum and behavioral responses [3].

The DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure-Adult

The DSM-5-TR Level 1 Cross-Cutting Symptom Measure is a psychiatric assessment tool that evaluates relevant mental health domains for psychiatric diagnoses [32]. It was developed by the American Psychiatry Association and has versions for adults, children, and parent/guardian reports [32,33]. While not a screening tool, it can be used diagnostically in clinical and research settings, aiding treatment evaluation [34]. The adult self-report version consists of a 23-item questionnaire assessing 13 domains of psychopathology, including depression, mania, anger, somatic symptoms, suicidal ideation, sleep problems, psychosis, memory problems, obsessive thoughts and behaviors, dissociation, personality functioning, and substance abuse [34]. The scale measures responses events in the last two weeks using a 5-point Likert scale and the total subscale score is calculated by summing the item scores. Research has demonstrated the validity and utility of the DSM-5-TR Level 1 Cross-Cutting Symptom Measure as a brief assessment tool for common mental health issues, aiding in identification and guiding healthcare decisions [35]. It has shown acceptable internal consistency and strong correlations among its items, indicating its potential value for assessing populations mental health [36].

The SLEEP-50

The SLEEP-50 is a self-reported questionnaire comprising 50 items aimed at screening sleep disorders in the general population. It includes nine subscales that correspond to common sleep-related disorders, aligning with categories outlined in the DSM-5, such as sleep apnea, insomnia, narcolepsy, restless legs/periodic leg movement disorder, circadian rhythm sleep disorder, sleepwalking, nightmares, factors influencing sleep, and the impact of sleep complaints on daily functioning [37]. The scale measures responses to events using a 4-point Likert scale and the total subscale score is calculated by summing the item scores.

The Coping Orientation to Problems Experiences Inventory

The Coping Orientation to Problems Experiences Inven-

tory (Brief COPE) is a self-reported questionnaire designed to explore effective and ineffective coping strategies for stressful life events. It consists of 28 items, divided into 14 scales, with each scale comprising 2 items. These scales assess different dimensions of coping, including self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame. The questionnaire aims to evaluate the various approaches individuals adopt when dealing with challenging situations. Each of the 28 items is scored on a scale ranging from 1 (indicating no engagement in the coping strategy) to 4 (indicating high engagement in the coping strategy). Higher scores on the subscales indicate a greater utilization of that coping strategy [38].

Statistical analysis

In this study, network analysis is used to visually depict the complex correlations between psychopathology domains, symptoms and signs, and sensory profiles. A Bayesian Network analysis was employed, specifically using the 2.0.3 BGGM package for R [39]. BGGM Gaussian graphical model which captures conditional (in)dependencies among a set of variables was used. These are pairwise relations (partial correlations) controlling for the effects of all other variables in the model, so the graphical aspect is the key in this type of analysis [39]. Age and sex were included as covariates in the analysis. The network theory of mental disorders [40] challenges the traditional view that symptoms are the result of a common underlying cause [41]. Instead, it considers mental disorders as an interconnected network of symptoms that cause or interact with each other. This approach provides a new perspective on psychopathology, treating mental illnesses as dynamic systems of symptoms and signs [41]. In network analysis, symptoms are represented as nodes, and the relationships between them are represented as edges (lines connecting them). Weighted edges are reported to represent the strength of the connection, as estimated by a partial coefficient: The thickness of the edge represents the strength of the unique shared association between each couple of nodes (symptoms) after adjusting for all other symptoms in the network. In the network, thicker edges indicate stronger associations; associations can be positive (green) or negative (red) [40,42].

Results

Sociodemographic characteristics

The sociodemographic characteristics are presented in Table I. A total of 508 adults participated in the study, with 54.7% female and 45.8% male participants. The mean age was 27.68 years (± 5.1). The study population exhibits the following characteristics: 68.3% of the population reported living in a parental or collateral family, 23.4% reported living with a partner, and 8.3% reported living alone. In terms of the number of siblings, 17.3% of individuals were only children, 56.7% had one sibling, and 26% had two or more siblings. Regarding marital status, 82.7% of people reported being single or unmarried, 14% were married for the first time, 1% were married with a prior marriage, 2% were separated or divorced, and 0.4% were widowed.

TABLE I. *Sociodemographic variables of the sample.*

Number	508
Age	27,68±5.1
Gender	
Female *N (%)*	278 (54.7%)
Male *N (%)*	230 (45.8%)
Marital status	
Unmarried *N (%)*	420 (82,7%)
Married for the first time *N (%)*	71 (14%)
Married with previous marriages *N (%)*	5 (1%)
Divorced *N (%)*	10 (2%)
Widowed *N (%)*	2 (0,4%)
Type of family	
Parental or collateral family *N (%)*	347 (68,3%)
Spouse or partner *N (%)*	119 (23,4%)
Alone *N (%)*	42 (8,3%)
Numbers of brothers and sisters	
1 *N (%)*	288 (56,7%)
≥2 *N (%)*	132 (26%)
0 *N (%)*	88 (17,3%)

Network analysis

Figure 1 and Table III display the Bayesian Network analysis and the strength of associations among the variables considered: sensory profiles, psychopathological domains, coping, and sleep disorders. The results demonstrate the following significant associations:

1. The sensory pattern of sensation seeking showed a positive association with coping. Additionally, sensation seeking was positively associated with mania.
2. The pattern of sensation avoiding was found to be positively associated with insomnia and coping.
3. Low registration, another sensory pattern, exhibited

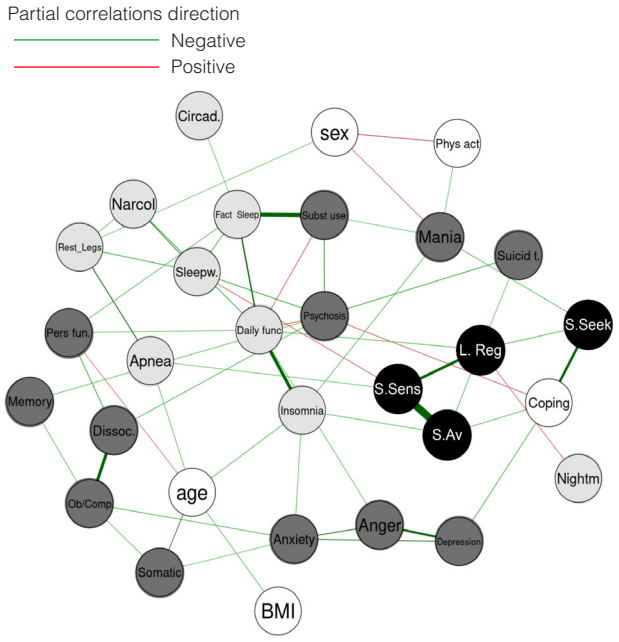

FIGURE 1. *Network of the association between sensory profiles, psychopathology, coping, and sleep disorders.*
Legend: Age, Age; Anger, Anger; Anxiety, Anxiety; Apnea, Sleep Apnea; BMI, Body Mass Index; Circad.; Circadian Rhythm Sleep Disorder; Coping, Use of coping strategies; Daily func, Impact of Sleep Complaints on Daily Functioning; Depression, Depression; Dissoc., Dissociation; Fact Sleep, Factors Influencing Sleep.; Insomnia, Insomnia; L. Low, Low Regression; Mania, Mania; Memory, Memory; Narcol, Narcolepsy; Nightm, Nightmares; Ob/Comp, Repetitive Thoughts and Behaviors; Pers fun., Personality Functioning; Phys Act, Physical Activity; Psychosis, Psychosis; Restl Legs, Restless Legs; S. Av, Sensation Avoidance; S. Seek, Sensation Seeking; S. Sens, Sensory Sensitivity; Sex, Sex; Sleepw, Somnambulism; Somatic, Somatic Symptoms; Subst use, Substance Use; Suicid t., Suicidal Ideation.

a positive association with suicidal thoughts and daily functioning, while negatively associating with nightmares.
4. Sensory sensitivity demonstrated a positive correlation with sleep apnea, while negatively associating with somnambulism.
These findings emphasize the relationships between specific sensory patterns and various psychopathological domains and sleep disturbances. Sensory seeking appears to be associated with coping abilities and certain mental health states, while sensation avoiding, and sensory sensitivity are related to sleep difficulties and emotional states.
Figure 2 and Table IV further investigates the relationship between the sensory profiles and coping mechanisms.

TABLE II. *Mean scores of scales/subscales in the sample.*

Higher scores correspond to a greater presence of the construct

Variable	Mean	Std. deviation
Sensory profiles		
Low registration	28.35	7.96
Sensation seeking	40.86	7.74
Sensory sensitivity	35.80	9.35
Sensation avoiding	35.08	8.49
Psychopathological domains		
Depression	4.61	1.25
Anger	1.90	1.16
Mania	3.23	2.14
Anxiety	5.67	3.23
Somatic symptoms	2.35	2.27
Suicidal ideation	.46	.98
Psychosis	.58	1.43
Memory	.74	1.13
Repetitive thoughts and behaviors	2.03	2.22
Dissociation	.72	1.10
Personality functioning	2.77	3.32
Substance use	1.64	2.42
Sleep disturbances		
Apnea	12.16	3.41
Insomnia	14.92	5.15
Narcolepsy	7.23	2.30
Circadian rhythm disturbances	4.97	2.20
Somnambulism	3.41	1.22
Nightmares	7.23	4.39
Factors influencing sleep	9.64	2.69
Daily functioning	13.26	4.61
Restless legs	5.65	2.04
Resilience factors		
Coping	64.98	10.01
Positive Reframing	5.38	1.65
Self-Distraction	4.91	1.54
Venting Emotions	4.64	1.44
Use of Instrumental Support	5.08	1.62
Active Coping	6.00	1.49
Denial	2.96	1.27
Religion	3.19	1.68
Humor	4.25	1.45
Behavioral Disengagement	3.23	1.26
Use of Emotional Support	5.01	1.64
Substance Use	2.46	1.08
Acceptance	5.99	1.43
Planning	6.17	1.50
Self-Blame	5.72	1.56

TABLE III. *Table of the association between sensory profiles, psychopathology, coping, and sleep disorders*

	Age	Sex	BMI	Phys Act	Coping	Low Reg	S Seek	S Sens	S Avoid	Depression	Anger	Mania	Anxiety	Somatic	Suicid T	Psychosis	Memory	Ob/Comp	Dissoc	Pers Fun	Subs Use	Apnea	Insomnia	Narcol	Circad	Somnam	Nightm	Fact Sleep	DailyFunc
Low Reg								0.28	0.41	0.26					0.25												-0.23		0.27
S Seek					0.42	0.28						0.26								-0.22									
S Sens						0.41			0.65		0.23											0.23				-0.26	0.23		
S Avoid					0.26	0.26		0.65												0.22			0.27						

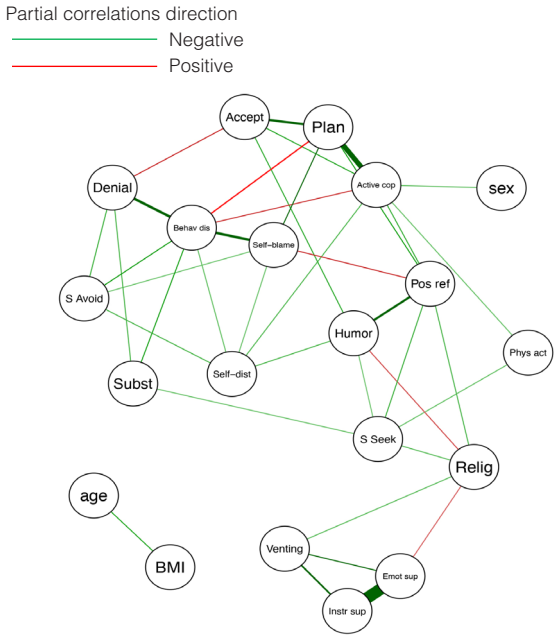

FIGURE 2. *Network of the association between Sensation Seeking, Sensation Avoidance, and coping subscales.*
Legend: Accept, Acceptance; Active cop, Active coping; Age, Age; Behav dis, Behavioral disengagement; BMI, Body Mass Index Denial, ignoring reality; Emot sup, Use of emotional support; Humor, Use of Humor Instr sup, Use of instrumental support; Phys Act, Physical Activity; Plan, Planning; Pos ref, Positive reframing; Relig, Religion; S. Av, Sensation Avoidance; S. Seek, Sensation Seeking; Self-Blame, Self-Accusation; Self-dist, Self-distraction; Sex, Sex Subst, Substance use; Venting, Venting Emotion.

1. The sensory pattern of sensation seeking was positively associated with Substance Abuse, Physical activity, Positive reframing, Religion and Humor.
2. The pattern of sensation avoiding was positively associated with Behavioral disengagement, Self-blame, Denial and Self-distraction.

Discussion

The primary aim of the present study was to examine the clinical and psychopathological associations of sensory processing in typically developed young adults, with reference to Dunn's four-quadrant model and its associations with psychopathological symptoms, sleep disturbances, and coping strategies. To this end, Bayesian network analyses were employed to explore the complex interplay between sensory experiences and psychological processes within a data-driven framework. The application of network theory provided an integrative perspective for understanding the interactions among these variables in the context of mental health [43]. The preliminary results of our study revealed a significant correlation between the AASP *sensation seeking* subscale score and coping abilities. Coping can be defined as a complex process that individuals engage into deal with various stressful events that challenge their personal resources [44]. Coping strategies can be broadly classified into two modalities: emotion-focused coping and problem-focused coping. Emotion-focused coping involves regulating stressful emotions, while problem-focused coping focuses on changing the person-envi-

TALE IV. *Table of the association between Sensation Seeking, Sensation Avoidance, and coping subscales*

	S Seek	S Avoid	Age	Sex	BMI	Phys Act	Pos Ref	Self-Dist	Venting	Instr Sup	Active Cop	Denial	Relig	Humor	Behav Dis	Emot Sup	Subst	Accept	Plan	Self-blame
S Seek						0.21	0.24						0.22	0.25			0.30			
S Avoid								0.23				0.24			0.28					0.28

ronment relationship causing the distress [44]. Problem-focused coping is associated with positive psychological states, whereas emotion-focused or avoidance coping is typically linked to high levels of stress. It is widely recognized that poor coping strategies can significantly impact both physical and mental health, and the emergence of many psychiatric disorders has been linked to ineffective coping strategies [45]. The positive correlation between *sensation seeking* and coping may suggest that this sensory profile is associated with more adaptive responses to stress, potentially contributing to resilience in the face of psychological difficulties. *Sensation seeking* has been found to have a positive correlation with vitality [46] and a negative association with anhedonia [47]. Another study also reported correlations between elevated *sensation seeking* and a greater use of coping strategies in a sample of individuals with affective disorders, supporting the notion that this profile may be a resilient feature for psychiatric conditions [48]. It appears that individuals with a *sensation seeking* profile are less likely to experience depressive symptoms, as their tendency to seek sensory input may serve as a buffer against stress [49]. On the other hand, a study conducted in Israel with 135 healthy individuals found that sensory hypersensitivity (*sensory sensitivity* and *sensation avoiding*) and *low registration* were correlated with state and trait anxiety [21].

Despite its role in resilience to psychiatric disorders, the *sensation seeking* profile is associated with impulsive behaviors, potentially leading to behavioral addictions or drug consumption [50]. Our results further support these literature findings, showing a positive relationship between sensation seeking and substance use. This correlation is direct in the network in Figure 2, which excludes psychopathological aspects. Interestingly, in Fig.1, this relationship is mediated by mania, suggesting elevated mood plays a role. This vulnerability in *sensation seeking* individuals might stem from elevated tonic dopaminergic tone and hyper-responsive midbrain dopaminergic responses to anticipated rewards, a possible neurobiological substrate of bipolar mania [51]. Dysregulations of the dopaminergic system are common to the sensation-seeking profile, bipolar disorder, and substance use. Therefore, it is not surprising that in individuals with bipolar disorder, substance abuse is significantly correlated with higher sensation-seeking patterns. In this population, substance use is driven by the desire to alleviate mood/anxiety symptoms, achieve or maintain euphoria, and increase energy [52]. The present findings suggest that the assessment of sensory profiles may be clinically relevant in OT, particularly when working with adults diagnosed with bipolar disorder or substance use disorders. While sensory-based interventions, most notably Ayres Sensory Integration® (ASI), are predominantly applied in pediatric populations with neurodevelopmental conditions such as autism spectrum disorder or ADHD, these results may indicate the potential utility of extending such approaches to broader clinical populations. Integrating sensory processing considerations into intervention planning could contribute to more personalized strategies aimed at enhancing emotional regulation and functional participation [53].

Regarding the coping styles, our data suggest a positive correlation between instrumental support and emotional supports as coping mechanisms. Moreover, planning and active coping showed strong positive associations, possibly indicating that individuals who engage in detailed planning are more likely to use active coping strategies effectively. This underscores the importance of targeted interventions that enhance planning skills to improve coping strategies. Indeed, these findings suggest that OT interventions should integrate multiple approaches. While sensory-based methods may offer valuable insights, cognitive-strategic frameworks like the Cognitive Orientation to daily Occupational Per-

formance (CO-OP) could also be relevant [54]. CO-OP approach has been extensively studied in pediatric populations and adults with neurological conditions, emerging evidence suggests its feasibility and potential benefits in adult mental health populations, particularly for individuals with mood, anxiety, or adjustment disorders. However, its implementation and effectiveness in these groups remain underexplored and warrant further investigation [55]. Furthermore, planning-based interventions, including self-management and occupational re-design models such as the Redesigning Daily Occupations (ReDO™) program, have shown promising outcomes in individuals with stress-related disorders, supporting the integration of structured planning into therapeutic processes [56,57].

Additionally, our findings indicated significant associations between sleep disorders and substance use. This finding is supported by literature that highlights a bidirectional relationship between sleep quality and substance use [58]. Regarding sex differences, it appears that among young adults, females show a lower tendency to engage in physical activity but are more likely to use active coping strategies. Furthermore, a strong positive correlation was found indicating that higher levels of insomnia are associated with worse daily functioning. Insomnia can significantly impair daily functioning by affecting cognitive processes, emotional regulation, and physical health. Literature suggests that poor sleep quality can lead to difficulties in concentration, memory impairment, and reduced problem-solving abilities, all of which can hinder daily tasks and overall productivity [59], and with increased levels of anxiety and depression, which further contribute to impairments in daily functioning [60].

Our results also revealed a positive correlation between the sensory profile of *sensation avoiding* and insomnia. Furthermore, the sensory pattern of *sensory sensitivity* showed a positive correlation with nightmares and sleep apnea. This evidence is consistent with previous studies that have found that extreme sensory-processing patterns characterized by a low neurological threshold, such as *sensory sensitivity* and *sensation avoiding*, predict poor sleep quality among adults [31] and patients with affective disorders [20]. Such findings emphasize the importance of recognizing and understanding the impact of sensory-processing patterns on sleep quality, particularly in individuals who exhibit signs and symptoms of poor sleep.

In occupational therapy, incorporating sensory assessments into the evaluation of individuals with sleep-related difficulties is increasingly supported by emerging evidence. Dysregulation in sensory processing has been associated with poor sleep quality, as sensory modulation influences arousal and self-regulation mechanisms critical for initiating and maintaining sleep [10]. OTs can utilize standardized sensory profiles to identify individual sensory processing patterns and tailor interventions accordingly. For example, weighted blankets, which provide deep pressure stimulation targeting tactile and proprioceptive senses, have been proposed as a non-pharmacological intervention to reduce restlessness and improve sleep in children with ADHD. Although evidence is still emerging, randomized controlled trials are underway to evaluate their efficacy on total sleep time, sleep onset latency, and functional outcomes, highlighting the potential of sensory-based strategies to enhance sleep quality and overall functioning [61]. Furthermore, environmental modifications that minimize sensory overstimulation and promote a calming atmosphere contribute to sleep hygiene and occupational performance [62]. Ho and Siu [26] identified four types of sleep intervention: use of assistive devices/equipment, use of activities, cognitive behavioral therapy for insomnia, lifestyle intervention. Gutman et al. [63] indicate that occupation-based sleep management can focus on three levels: i) person: minimizing the influence of bodily function on sleep; ii) environment: promoting environment conducive to sleep; iii) occupation: restructuring daytime activity. This information has the potential to guide the creation of interventions that are specifically tailored and impactful in assisting individuals to enhance their coping abilities and overall mental health. By evaluating sensory profiles through tools such as the AASP, it becomes possible to pinpoint individuals who may be vulnerable, thus enabling the implementation of personalized interventions designed to alleviate stress and enhance their life quality [16]. By considering individuals' sensory needs, interventions can be tailored to maximize their ability to perceive stimuli from their surroundings, improve their emotional well-being, and enhance their interactions with others [64]. Occupational therapists can collaborate with individuals to develop personalized sensory diets, incorporating occupations that align with their sensory preferences and aversions. This may involve introducing activities that provide sensory input, such as deep pressure or proprioceptive activities, to promote a sense of calm and regulate arousal levels [65]. Social skills training programs, informed by an understanding of individuals' sensory processing preferences, can enhance their ability to navigate social interactions more effectively.

OTs are well-positioned to deliver these personalized treatment approaches. By considering the nuanced interplay between sensory profiles and mental health, interventions can be crafted to enhance overall well-being and functioning. This holistic approach acknowledges the individuality of sensory experiences and underscores the importance of tailoring interventions to

meet the unique needs of each person. The integration of sensory considerations into therapeutic approaches has the potential to significantly impact individuals' coping abilities, emotional well-being, and overall quality of life.

Limitations

One major limitation of this study is its cross-sectional design, which restricts the assessment of individuals' psychopathological domains over an extended period. Psychiatric illnesses cannot be accurately categorized within a short timeframe and often necessitate longitudinal follow-up by trained healthcare professionals. Additionally, the reliance on self-report questionnaires introduces the potential for biased results due to participants' limited insight. Another important limitation is the lack of evaluation of the psychometric properties of the AASP within the Italian population. This gap limits the interpretability and generalizability of the findings in the cultural context of Italy. Future studies should aim to validate the instrument in Italian samples to ensure its reliability and validity. To overcome these limitations and establish the generalizability of the findings, further longitudinal research is necessary. By incorporating longer-term observations and employing diverse assessment methods, such as clinician interviews and objective measures, a more comprehensive understanding of the relationship between psychopathology and sensory profiles in adults can be achieved.

Conclusion

The present study aimed to explore the correlations between DSM-5 psychopathology domains and sleep disorders, as well as coping strategies and sensory profiles, in a sample of healthy young adults from the general population. The findings suggest a significant relationship between *sensation seeking* and coping abilities, indicating that this sensory profile may act as a protective factor against mental health problems. In contrast, *sensation avoiding* was primarily associated with maladaptive coping styles. Furthermore, heightened sensitivity to sensory stimuli was found to be associated with sleep difficulties. Sensory processing was recognized as a valuable tool in improving patients' insight and tailoring interventions to enhance their well-being and functioning. The study underscores the importance of considering sensory profiles in assessing and treating individuals with mental health conditions. Future research should focus on understanding the underlying mechanisms and developing personalized interventions that address individuals' unique sensory needs.

Acknowledgements

We acknowledge Professor Romolo Rossi (Genoa, 1934-2024) for his enduring and irreplaceable contribution to the development of Psychiatry.

Funding

None.

Conflict of interest statement

The authors do not have any conflicts of interest to declare.

Authors' contributions

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Ethical consideration

The study was conducted in accordance with the Declaration of Helsinki and was approved by the local Ethics Committee (approval code: 366/2019 - DB id 10137)

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