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Exploring Wellbeing Profiles, Mindfulness, Compassion and Personality Traits in Regular Ashtanga Yoga Practitioners: A Cluster Analysis

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Abstract

Objective Studies describing wellbeing, mindfulness, and personal characteristics of long-term yoga practitioners are uncommon, yet helpful for understanding the benefits stemming from yoga. This study investigated Ashtanga Yoga practitioners' (AYPs) wellbeing profiles to identify potential similarities and differences depending on practitioners' personal characteristics and their level of expertise with yoga.

Method A purposeful sample ($n = 199$) of regular AYPs was selected from a broader online survey assessing wellbeing, health, yoga, and personal traits. Hierarchical and k -means clustering were used to explore and define clusters.

Results Statistical analysis identified six distinct clusters characterising AYPs. Practitioners from all clusters experienced high levels of wellbeing, believing that their yoga practice had a positive impact on it. The six clusters differed in practitioners' engagement with physical, mental, and spiritual aspects of the Ashtanga yoga practice, in their levels of wellbeing, and in which dimensions of wellbeing were perceived as being most influenced by their yoga practice.

Conclusions Findings from this study suggest that beyond years of practice and *asana* sequence, the engagement with different aspects of the yoga practice relates to varying wellbeing outcomes. This shines a light on how to leverage specific aspects of the yoga practice to consolidate changes based on the type of practitioner. Further examination of the mechanisms of yoga is needed in future research.

Preregistration This study was not preregistered.

Keywords Ashtanga yoga · Yoga practitioners · Cluster analysis · Wellbeing · Personal traits

Yoga can be defined as a holistic practice encompassing the physical, mental, and spiritual dimensions of the individual, involving the evolution of individual consciousness and its connection with universal consciousness (Iyengar, 2005; Vivekananda, 2012). Originated in the Hindu valley thousands of years ago, yoga arrived in Westernised countries about a century ago (De Michelis, 2005) and is typically practised by focusing on physical postures, breathing exercises, and meditation (Büssing et al., 2012; Riggins, 2013).

With an exponential growth in the past two decades, millions of practitioners around the world engage in a range of styles offered in different settings (McCrary, 2013), mainly for the improvement of physical and mental health (Cramer et al., 2016; Park et al., 2019). The health and wellbeing benefits of yoga have been well documented in the academic literature. Several systematic reviews have examined yoga interventions supporting improvements of ill-health conditions including asthma (Cramer et al., 2014), high blood pressure (Hagins et al., 2013), chronic neck pain (Cramer et al., 2017a), low back pain (Cramer et al., 2013a, 2013b, 2013c; Holtzman & Beggs, 2013), and depression (Cramer et al., 2013b), amongst others. Other research shows that yoga can promote increases in subjective wellbeing in both clinical and general populations (Cramer et al., 2012, 2013c; Hendricks et al., 2017; Ivtzan & Papatoniou, 2014). However, much of this evidence is based on the use of yoga as a short-term intervention rather than a long-term practice.

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According to the *Yoga Sutras*, the understanding of yoga and related benefits emerge after long-term dedicated practice (*Yoga Sutra I.14*; Iyengar, 2005). Research supports this statement, indicating that long-term practitioners have distinct biophysiological and psycho-biological features. These include increased cortical thickness related to memory and awareness (Afonso et al., 2017), metabolic, autonomic and physiological resilience and homeostatic capacity (Tyagi et al., 2016), sleep quality and hormonal modulation (Vera et al., 2009), and telomere length (Krishna et al., 2015). Practitioners perceive positive changes in different life domains due to their yoga practice, including specific health conditions (Penman et al., 2012); vitality, happiness, relationships, and sleep (Ross et al., 2013); and general health, fitness, and relaxation (Park et al., 2015, 2019). In addition, regular yoga practitioners tend to experience reduced stress and enhanced levels of emotional, psychological and spiritual wellbeing, with greater frequency and regularity of the practice related to greater benefits (Brisbon & Lowery, 2011; Gaiswinkler & Unterrainer, 2016; Ivtzan & Papantoniou, 2014; Moliver et al., 2013). The frequency and the longevity of the yoga practice appear to be intricately related to perceptions of health and wellbeing benefits (Park et al., 2019; Ross et al., 2012, 2013) as well as healthier lifestyles (Cramer et al., 2017b, 2019; Penman et al., 2012). Furthermore, studies reveal that in general, yoga practitioners report high levels of wellbeing, even when practitioners may display high levels of mental illness symptoms (Cartwright et al., 2020; Cramer et al., 2019; Dos Santos et al., 2022; Ross et al., 2013). Thus, focusing research on regular yoga practitioners allows the examination of trends in health and wellbeing outcomes that people experience with a sustained practice.

Certain personal traits have also been documented as more prominent in yoga practitioners. Studies have found that seasoned practitioners and those with high involvement in their yoga practice report higher levels of mindfulness compared to other groups (Brisbon and Lowery, 2011; Gaiswinkler & Unterrainer, 2016; Kishida et al., 2018; Miyata et al., 2015). People who engage in short-term yoga programmes also have reported enhanced mindfulness after participating (Cox & McMahan, 2019; Matko et al., 2022). Similarly, both long-term (Ivtzan & Papantoniou, 2014) and short-term engagement in yoga (Ahmadi et al., 2016) have been associated with higher levels of gratitude. Research has also found that people who engage in either long-term practice or short-term yoga interventions can display increased levels of self-compassion and other-compassion (Gard et al., 2012; Kishida et al., 2018). Personality traits have also been explored in yoga research, with increased openness to experience being reported by regular practitioners (Piletić & Čabarkapa, 2010) and extraverted and conscientious practitioners being found to benefit more from a longer practice (Kobylynska et al., 2018). In sum, a steady yoga practice can contribute to positive health and wellbeing outcomes as well as to the enhancement of personal

characteristics. While this points to the relevance of investigating regular practitioner experiences, it also raises the question of which aspects of the practice lead to these outcomes.

Notably, some surveys have found that physical health variables were associated with the *asana* practice (Cramer et al., 2019; Ross et al., 2012), whereas *pranayama* and meditation were linked to mindfulness and subjective wellbeing (Ross et al., 2012). The implications of yoga philosophy have been less studied in yoga practitioners, but some evidence shows that the inclusion of philosophical aspects in the practice may contribute to enhanced health (Ross et al., 2012). Thus, different elements of the practice seem to contribute to specific benefits. Gard et al. (2014) proposed a conceptual framework of the mechanisms of yoga for health that includes multiple facets of yoga and incorporates the eight limbs of the *Yoga Sutras of Patanjali*. These comprise *yama* and *niyama* (universal moral principles and behaviours with others and oneself), *asana* (physical postures), *pranayama* (breathing techniques), *pratyahara* (shifting attention inwards), *dharana* (concentration of attention), *dhyana* (meditation), and *samadhi* (a state of bliss and sense of oneness) (Iyengar, 2005). However, the literature on how different components of yoga are relevant to long-term practitioners and how they benefit from the different aspects of yoga is scant. More is known about the characteristics of yoga practitioners in general, rather than on how specific characteristics relate to different aspects of wellbeing.

Various cross-sectional surveys describe yoga practitioners as typically being middle-aged and highly educated women living in urbanised areas in Westernised countries, who identify themselves as Caucasian (Cagas et al., 2022a; Cramer et al., 2017b, 2019; Dos Santos et al., 2022; Park et al., 2015, 2019; Penman, 2008; Penman et al., 2012; Ross et al., 2012, 2013; Telles et al., 2017; Schröter & Cramer, 2021; see Online Resource 1 for a summary of relevant studies). This trend has also been reported in Latin American countries (Lizama Lefno, 2015). It is also known that practitioners tend to initiate a yoga practice mainly for physical and mental health reasons, and while maintaining the physical benefits, they seem to shift towards more psychospiritual motivations as they develop a long-term practice (Büssing et al., 2012; Ivtzan & Jegatheeswaran, 2015; Park et al., 2015, 2019). Furthermore, female practitioners may have different motivations compared to male practitioners (Cagas et al., 2022a). However, few studies have looked at different types of yoga practitioners with the aim of identifying profiles of different sub-groups of practitioners.

Notably, several recent studies have moved beyond basic descriptives to examine types of yoga practitioners' profiles (Table 1). Kramer-Kostecka and collaborators (2022) investigated practitioners' motivational profiles and their associations with physical and psychological health using latent class analysis. Practitioners with high levels of mindfulness and low levels

Table 1 Summary of studies examining yoga practitioners' profiles

Authors	Study aim	Type of study	Variables included	Yoga styles	Key findings
Cagas et al. (2022b)	Perceptions of yoga, motivations for practice, yoga immersion, and practice characteristics amongst yoga practitioners	<i>Two-step Cluster Analysis</i> (profiles based on perception of yoga and yoga immersion) ($n = 546$) <i>MANCOVA</i> (differences in motivations for practising) ($n = 530$)	<ul style="list-style-type: none"> Socio-demographics Perceptions of yoga (i.e. physical, psycho-spiritual or lifestyle practice) Yoga immersion (i.e. degree of engagement with psycho-spiritual aspects) Motivation for practising (e.g. positive affect, fitness, nimbleness, mind-body integration, coping stress, health, spirituality) 	<ul style="list-style-type: none"> Ashanga yoga Hatha yoga Hot yoga Jivamukti yoga Iyengar yoga Power yoga Sivananda yoga Vinyasa yoga Yin yoga 	<p>The Exercisers: perceived yoga more as a physical practice than a psycho-spiritual practice, and had low levels of yoga immersion</p> <p>The Yogis: perceived yoga more as a psycho-spiritual practice rather than a physical practice, and had high levels of yoga immersion</p> <p>The Postural Yogis: perceived the practice as both physical and psycho-spiritual, and had high levels of yoga immersion</p> <p>Cluster A: highly valued spirituality and the physicality of the practice, and while holding positive evaluations of their appearance, they were less physically orientated</p> <p>Cluster B: similar perceptions in terms of physical aspects, but were less spiritually inclined</p> <p>Cluster C: more physically orientated while holding more negative perceptions about their appearance</p>
Genovese and Fondran (2017)	Practitioners' psychological profiles by examining their spiritual and bodily perceptions	<i>Non-parametrical Cluster Analysis (k-means)</i> ($n = 261$)	<ul style="list-style-type: none"> Socio-demographics Spirituality (e.g. cognitive, orientation, experience, existential wellbeing) Body image (e.g. appearance, fitness, health, illness) 	<ul style="list-style-type: none"> Anusara yoga Ashanga yoga Baptiste yoga Hatha yoga Integral yoga Iyengar yoga Kripalu yoga Kriya yoga Kundalini yoga Restorative yoga Satananda yoga Sivananda yoga Viniyoga yoga Vinyasa yoga 	<p>The Pragmatists: no major disruptive life events and practised yoga for physical and mental wellbeing</p> <p>The Explorers: no major adverse life event, but in addition to physical and mental benefits, they also practised for self-exploration and growth</p> <p>The Self-Helpers: experienced a traumatic event in the past and tended to practice for therapeutic reasons and as a way of personal growth</p> <p>The Mystics: fully embraced yoga philosophy and spirituality, and practised yoga as a lifestyle by following physical and mental practices, as well as ethical principles</p>
Henrichsen-Schrembs and Versteeg (2011)	Develop a typology of yoga practitioners in relation to the motivations for practising yoga and their life course	<i>Grounded Theory</i> ($n = 27$)	<ul style="list-style-type: none"> Motives of yoga practice Integration of yoga into one's life Subjective wellbeing experienced through practising yoga Perceptions of oneself and life Self-development as part of the yoga practice 	<ul style="list-style-type: none"> Hatha yoga Iyengar yoga Kundalini yoga Vini yoga 	<p>The Pragmatists: no major disruptive life events and practised yoga for physical and mental wellbeing</p> <p>The Explorers: no major adverse life event, but in addition to physical and mental benefits, they also practised for self-exploration and growth</p> <p>The Self-Helpers: experienced a traumatic event in the past and tended to practice for therapeutic reasons and as a way of personal growth</p> <p>The Mystics: fully embraced yoga philosophy and spirituality, and practised yoga as a lifestyle by following physical and mental practices, as well as ethical principles</p>

Table 1 (continued)

Authors	Study aim	Type of study	Variables included	Yoga styles	Key findings
Kramer-Kostecka et al. (2022)	Identifying motivational profiles in yoga practitioners and their associations with physical and psychological health	<i>Latent Class Analysis</i> (motivation profiles) <i>Multinomial Logistic and General Linear Models</i> (associations between profiles, physical health and psychological health) ($n = 297$)	<ul style="list-style-type: none"> • Socio-demographics • Motivation for practising yoga (e.g. fitness, stress, appearance, awareness, spirituality) • Physical health behaviours (i.e. hours of physical activity and yoga) • Psychological factors (e.g. self-esteem, depression, stress) 	<ul style="list-style-type: none"> • Not specified 	High levels of mindfulness and low levels of motivations towards physical appearance were associated to higher levels of physical and psychological health

of motivations towards physical appearance were more likely to display higher levels of physical and psychological health. While this reinforces the relevance of cultivating an internal focus through the yoga practice, these profiles were limited to psychological variables mostly related to eating behaviours and ill-health.

Henrichsen-Schrembs and Versteeg (2011) used a grounded theory approach to study types of yoga practitioners in relation to motivations to practise, including physical and mental wellbeing, and their life course, identifying four groups: *the pragmatists*, *the explorers*, *the self-helpers*, and *the mystics*. The groups differed in terms of experiencing major disruptive life events and whether they mainly practised for wellbeing, personal growth, healing trauma, or as a lifestyle. These findings indicate that life circumstances may influence practitioners' intentions for practising yoga. Nevertheless, associations with health and wellbeing outcomes were not explored.

Two studies have looked at yoga practitioners' profiles using cluster analysis. Genovese and Fondran (2017) analysed yoga practitioners' psychological profiles by examining their spiritual and bodily perceptions. Using non-parametrical cluster analysis, they identified three groups of practitioners. More seasoned practitioners were more likely to value both the physical and spiritual aspects of the practice, while less experienced practitioners were more likely to be physically oriented and hold negative perceptions of their physical self. Interestingly, differences in terms of years of practice imply a trajectory occurs across various stages of yoga practice. However, differences might also be explained by the level of immersion with yoga. Using two-step cluster analysis, Cagas et al. (2022b) assessed perceptions of yoga, motivations for practice, yoga immersion, and practice characteristics amongst regular yoga practitioners. They identified three clusters: the exercisers, the yogis, and the postural yogis. They found that perceiving yoga as a psycho-spiritual practice was related to the level of yoga immersion, and not necessarily to years of practice.

Despite the valuable contributions of these studies, more research is required to understand the profiles and trajectories of regular yoga practitioners (Cagas et al., 2022b; Genovese & Fondran, 2017), especially for different types of yoga practice. Previous research looking at yoga practitioners' profiles has mostly included a range of yoga styles. While focusing on a wider diversity may enable generalisations about yoga and the people who practice, the heterogeneity of styles can undermine more specific conclusions. Focusing on one yoga tradition as well as on regular practitioners can provide additional insights to the existing literature on practitioners' profiles. Furthermore, wellbeing and personal traits have been under-studied for long-term yoga practitioners' profiles (e.g. Bright et al., 2021; Yadav et al., 2015). While the current understanding is that practitioners tend

to report high levels of wellbeing and to endorse positive changes in health and wellbeing to their yoga practice, it is less clear which dimensions of wellbeing are impacted in different types of practitioners. Moreover, selecting a range of variables for health, wellbeing and personal attributes beforehand without enforcing the clustering process to high or low levels of a couple of variables would allow exploring and describing what emerges from participants, rather than setting pre-existing boundaries. Thus, a non-parametrical cluster analysis including perceptions of different dimensions of wellbeing in practitioners following a specific yoga tradition could offer additional insights into the studies described above.

Here, we focus on established practitioners within one yoga tradition: Ashtanga Yoga practitioners (AYPs). Ashtanga yoga (AY), also known as Ashtanga Vinyasa yoga, is a method with distinct teaching and learning features. AY is usually taught individually within a group setting (i.e. Mysore style), where the teacher gradually guides the student through a sequence of postures according to their needs and context, while supporting their own practice. The progressive nature of the *asana* practice enables the cultivation of strength, mental steadiness, and health over time (Jois, 2016). The focus on a particular *drishti* or gazing point with each *asana* allows the direction of attention and concentration during the practice, facilitating a meditative state (Maehle, 2006). The continuous flow and lengthening of the breath with a gentle sound while moving through the *asana* sequence is another feature of the practice. Breathing, *asana*, and *drishti* are known as *tristhana*: the three pillars of the practice. Additionally, *vinyasa* (i.e. synchronisation of breath and movement) is threaded throughout the practice (Jois, 2018).

It is argued that the AY method can condense the eight limbs of the *Yoga Sutras of Patanjali* into one complete practice: by performing *asana* while using long and steady breath (*pranayama*) and *drishti*, the mind is able to focus (*dharana*), go inwards (*pratyahara*) and thus, cultivate meditation in movement or *dhyana* (Maehle, 2006). Furthermore, the *asana* practice can promote the dissolution of impurities, foster engagement with moral principles and behaviours (*yamas* and *niyamas*), and nurture self-transcendence or *samadhi* (Jois, 2018). The practice may also involve other elements such as chanting opening and closing *mantras*, use of energy seals or *bandhas*, and resting during certain days of the month. In general terms, AY is a systematised practice that encourages a regular and long-term practice typically involving 90-min sessions 4–6 days a week.

Previous research on AYPs has looked at health and wellbeing outcomes (cf. van Aalst et al., 2020; Phillips, 2005), as well as their conceptualisations of overall wellbeing, different dimensions of wellbeing, and yoga (cf. Ramirez-Duran et al., 2022a, 2022b, 2025). Here, we consider wellbeing

broadly defined as feeling good and functioning well (Deci & Ryan, 2008; Huppert, 2014). Yet, since the evaluation of wellbeing depends on individual conceptualisations of wellbeing (Mitchell & Alexandrova, 2021), we propose a participatory approach where participants can quantitatively evaluate their wellbeing in different dimensions while considering their own definitions, in line with previous research using a social-constructivist paradigm and ideographic approach.

The current study focused on exploring regular AYPs' wellbeing and AY practice profiles. The study aimed to investigate (1) how perceptions of wellbeing varied across regular AYPs, depending on the characteristics of the practitioner, and (2) whether regular AYPs have distinctive profiles according to their expertise with yoga. The study employed a quantitative research design, complementing previous studies on regular AYPs (cf. Ramirez-Duran et al., 2022a, 2022b, 2025), which have mainly used qualitative approach to examine perceptions of wellbeing.

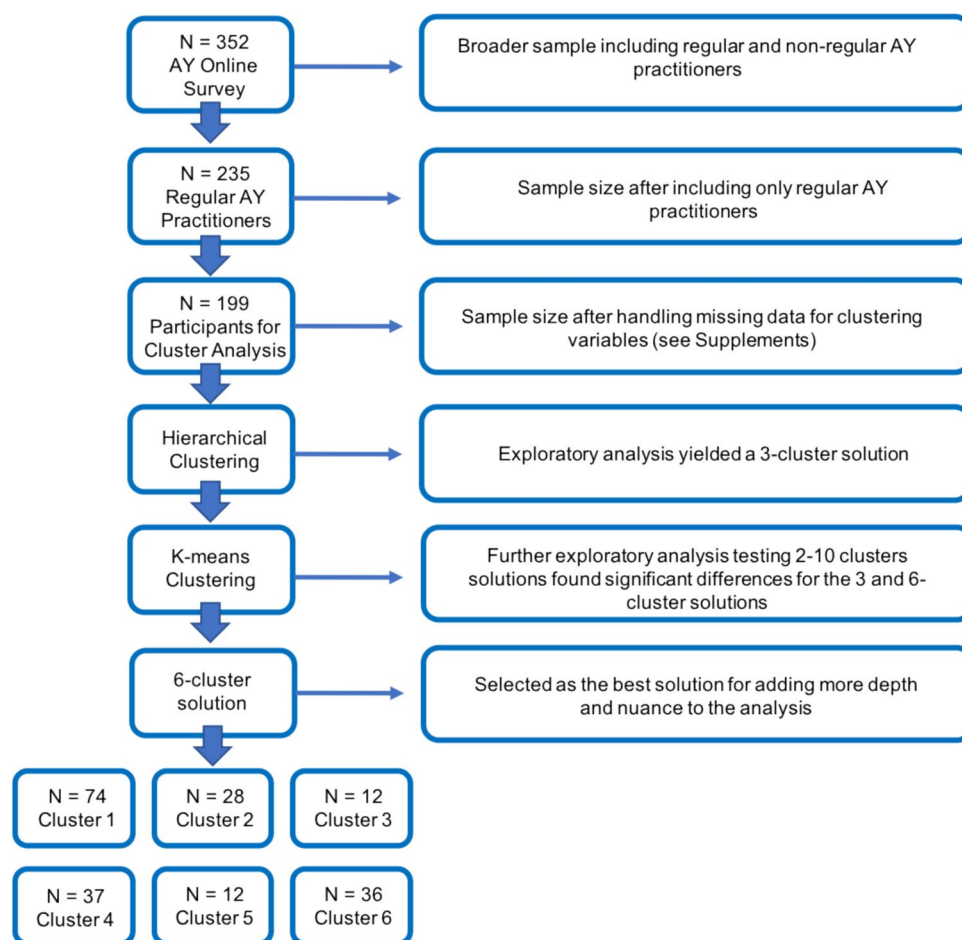
Method

Participants

Participants were purposefully selected for this study. Of the larger sample of 352 respondents to the broader online survey, 235 participants considered themselves to be regular AYPs. A total of 199 participants were purposefully included in this study, after excluding 36 participants due to missing data in one or more of the 16 variables used for clustering (Fig. 1). We used listwise deletion, which excludes any case with missing data on any of the variables (i.e. the 36 excluded participants). This may bias results to participants who provided answers to the relevant variables and substantially reduce data size, but in this case, we had sufficient power to create coherent clusters with the participants who completed each question. Listwise deletion may also bias the results if data is not missing at random, but no pattern to the missing data was found. Thus, listwise deletion was determined to be sufficient as it is the most straightforward approach and is appropriate when sample size is sufficient and data are missing at random. Still, this assumes that data is missing at random, and results may be biased if this is not the case.

Participants were fluent in English and/or Spanish and had a range of demographic and AY characteristics. Most participants identified as female (80.91%) and Caucasian (67.34%), ranged from 25 to 34 years old (31.66%) and 35 to 44 years old (28.14%), held a tertiary education or post-graduate degree (86.43%) and were located in either the Americas (36.68%) or Europe (31.16%). The majority did not identify with any spiritual tradition (27.14%), or defined themselves as atheist or agnostic (25.70%). Most of

Fig. 1 Data analysis process



this group had practised regularly for 3 to 5 years (31.16%), 6 to 10 years (18.59%) and 1 to 2 years (16.58%), typically consisting of early morning sessions (63.32%) 5 to 6 days per week (53.27%), with each session lasting about 60 to 80 min (31.66%). Most practitioners were practising from full primary series (27.64%) up to the first half of intermediate series (31.66%) in either a Mysore-only style class (43.22%) or a combination of Mysore and Traditional Sanskrit-counted led classes (24.62%). Their practice usually included *vinyasa* (96.48%), *drishti* (93.97%), free breathing with sound (90.45%), and use of *bandhas* (90.45%). In terms of the eightfold path framework, participants were more likely to include *asana* and *pranayama*, and to experience *dhyana* to a greater extent compared to the other elements. They generally considered yoga philosophy relevant to their lives (76.38%) and engaged with related activities such as reading texts and books (82.41%), reading social media posts (50.25%) or reading blogs (48.74%) at least once per month (80.91%) (see Online Resources 2–4 for a detailed description of demographic characteristics and AY practice).

Those included in the current study were more consistent in their yoga practice ($t(290) = 6.12, p < 0.001$), and were likely to practise yoga for more years ($c^2 = 23.95, p = 0.002$)

than those excluded. They were more likely to practise at home by themselves ($c^2 = 33.61, p < 0.001$), practised different sequences ($c^2 = 29.52, p = 0.006$), and were more likely to experience a meditative state while practising ($c^2 = 26.57, p = 0.002$). They were more likely to engage with yoga philosophy in different forms. They were more likely to start practising and continue practising for their physical, mental, and spiritual wellbeing. They rated their physical health as better ($t(187) = 3.48, p < 0.001$), and were more likely to believe that their yoga practice influenced their physical, emotional, social, and spiritual wellbeing. Other demographic, personality, and health variables did not significantly distinguish between those included and excluded from the study.

Procedure

The study used an intentional sample from a broader online survey focusing on AY and wellbeing comprising 352 participants across 42 countries. We launched the survey in April 2020, which included quantitative and qualitative items assessing aspects of wellbeing, health, yoga practice, personality traits, and demographic information. Participants could access the survey in English or Spanish until August 2020

through Qualtrics software (version 2020). All questions from the survey were translated into Spanish by the lead author, who is a bilingual and native Spanish speaker. All questions were then back-translated by another bilingual speaker.

Practitioners were recruited online using social media platforms (i.e. Facebook, Instagram, Reddit, LinkedIn) and via electronic communication from yoga studios and/or teachers that were contacted by the lead author, who is a regular AYP. The lead author was responsible for designing and disseminating the survey and collecting and managing data. Both authors were responsible for analysing data. Data was analysed using SPSS software (version 28) and the psych package within R (version 4.3.3). This study was not conducted in the interest of any particular AY studio, centre or association.

Measures

Questions about wellbeing and AY were devised specifically for this study, including questions with multiple and single choices, as well as quantitative questions using an 11-point Likert scale (i.e. 0 to 10). We included six self-administered questionnaires to measure different personal traits. These scales were preferred due to their shortened length to reduce participants' burden.

Ten Item Personality Inventory (TIPI; Gosling et al., 2003).

A 7-point Likert scale with 10 items measuring five personality traits: openness to experience, emotional stability, conscientiousness, agreeableness, and extraversion. Two items measured each personality trait with a list of characteristics such as "Extraverted, enthusiastic" and "Calm, emotionally stable", which respondents rated from *strongly disagree* to *strongly agree*. Reliability could not be calculated for the personality traits due to having only 2 items per trait.

Gratitude Questionnaire Six-Item Form (GS-6; McCullough et al., 2001).

A 7-point Likert scale with six items measuring gratitude as a trait. Items included statements such as "I have so much in life to be thankful for" and were rated from *strongly disagree* to *strongly agree*. Cronbach's alpha was 0.79 and McDonald's omega estimate was 0.89.

Freiburg Mindfulness Inventory Short Form (FMI-SC; Walach et al., 2006).

A 5-point Likert scale with 14 items measuring four facets of mindfulness: cognitive (e.g. "I pay attention to what is behind my actions"), process (e.g. "I feel connected to my experience in the here-and-now"), acceptance of experience (e.g. "I accept unpleasant experiences"), and non-judgement (e.g. "I am impatient with myself and others"). Items were rated from *almost never* to *almost always*. Cronbach's alpha reliability score was 0.90 and McDonald's omega was 0.92.

Santa Clara Brief Compassion Scale (SCBCS; Hwang et al., 2008).

A 5-point Likert scale with five items measuring compassion towards others. Items included statements like "I tend to feel compassion for other people, even though I do not know them", which were rated from *not at all true of me* to *very true of me*. Cronbach's alpha reliability score was 0.80 and McDonald's omega was 0.87.

Self-compassion Scale Short Form (SCS-SF; Raes et al., 2011).

A 5-point Likert scale with 12 items measuring six dimensions of self-compassion: self-kindness (e.g. "I try to be understanding and patient towards those aspects of my personality I don't like"), self-judgement (e.g. "I'm disapproving and judgemental about my own flaws and inadequacies"), common humanity (e.g. "I try to see my failings as part of the human condition"), isolation (e.g. "When I fail at something that is important to me, I tend to feel alone in my failure"), mindfulness (e.g. "When something upsets me I try to keep my emotions in balance"), and over-identification (e.g. "When I'm feeling down I tend to obsess and fixate on everything that's wrong"). Items were rated from *strongly disagree* to *strongly agree*. Cronbach's alpha reliability score was 0.84 and McDonald's omega was 0.88.

Quiet Ego Scale (Wayment et al., 2015).

A 5-point Likert scale including 14 items measuring a higher order latent factor representing a subjective balanced view of oneself and others. The scale includes four dimensions: detached awareness (e.g. "I find myself doing things without paying much attention"), perspective taking (e.g. "I try to look at everybody's side of a disagreement before I make a decision"), inclusive identity (e.g. "I feel a connection between to all living things"), and growth (e.g. "I have the sense that I have developed a lot as a person over time"). Items were rated by participants from *strongly disagree* to *strongly agree*. Cronbach's alpha reliability score was 0.82 and McDonald's omega was 0.87.

For this study, we included a selection of questions from the online survey that were used for either clustering or for subsequent description of clusters (see Table 2 and Online Resources 5–6 for details).

Data Analyses

Descriptive Analysis

We used distributions and central tendencies of a range of variables to provide an overview of the broader group of regular AYPs included in this study. This allowed us to explore similarities and differences amongst participants prior to the cluster analysis. This analysis helps answer the research question on whether regular AYPs have distinctive profiles according to their expertise with yoga.

Table 2 Sample of nominal and ordinal variables selected for clustering

Type of variable	Survey item	Values
Nominal	What elements does your Ashtanga Yoga practice include? Select all that apply	Free breathing with sound Use of <i>bandhas</i> Use of <i>drishti</i> Chanting opening and closing mantras Meditation before or after practice Pranayama before or after practice Resting on moon days <i>Vinyasa</i> throughout practice
Ordinal	In a scale from 0 to 10, with 0 being not at all and 10 being completely influenced, to what extent each of the following areas of wellbeing have been positively influenced by your yoga practice? Physical wellbeing	0–10 (0 = not at all, 10 = completely)

Cluster Analysis

Clustering is a set of data mining techniques that is used to identify, classify, and group patterns of data. In this study, we selected 15 variables across three categories: (1) demographics, (2) AY practice expertise, and (3) AY Philosophy. Participants' responses on each item were used as features, which were used by the chosen algorithms for clustering (see Online Resources 5–6 for more details).

For purposes of this study, we used hierarchical and *k*-means clustering to answer two research questions: (1) how perceptions of wellbeing varied across regular AYPs, depending on the characteristics of the practitioner, and (2) whether regular AYPs have distinctive profiles according to their expertise with yoga. We followed the five steps proposed by Frades and Matthiesen (2010) to guide our cluster analyses: (1) sequentially represent patterns, (2) determine similarity measure, (3) choose a clustering algorithm, (4) assess the output, and (5) create graphical representations of clusters.

Hierarchical clustering is an exploratory approach that iterates through the data to build a hierarchy of clusters, splitting large clusters (i.e. the data from 199 participants) into smaller clusters. We first used hierarchical clustering as an exploratory analysis to identify the possible number of clusters. Hierarchical clustering uses the distance between data points as the criterion to determine similarity between other members of the cluster and differentiation from others (i.e. cluster membership). This method generates a dendrogram (i.e. a tree of groups that were sub-divided into smaller clusters by iteratively splitting and merging data points), which visually illustrates the association between the clusters. The clustering process suggested two, three, or six clusters as possible solutions.

We then used *K*-means clustering, which creates a pre-defined number of clusters, assigning each data point to the cluster with the closest mean, with the goal of minimising

the distance between each data point and the cluster that it is assigned to. We extracted two to six clusters, looking at both the metrics from the clustering process and the interpretability of the resulting clusters (see Online Resource 7). Looking at the clusters, we determined which clusters had a sufficient number of cases to be interpreted, large separation amongst clusters ($D > 4$), along with a coherent pattern of responses. In this case, the six clusters gave the most detailed yet still interpretable solution, with variability across the clusters apparent in the ANOVA comparing the clusters, balanced with a sufficient number of participants in each cluster to provide meaningful results.

Power indicates the probability of detecting sub-groups from the main sample. Simulation analyses have indicated that with *k*-means, power is primarily driven by cluster separation rather than by sample size, with power being sufficient with fairly small sub-samples ($n = 20$ per group), provided that cluster separation is large ($D = 4$; Dalmaijer et al., 2022). For six clusters, cluster separation was 10.86, indicating that there was sufficient power to detect differences between the clusters. Two of the clusters in the six-cluster solution only had 12 participants per cluster, such that power may be insufficient for two of the six clusters. However, since overall cluster separation was greater than 4, we proceeded with analyses for the six-cluster solution. To test cluster stability, we removed the non-significant variables. Cluster membership slightly shifted for some participants, suggesting that the clustering is dependent upon which variables are included in the analysis, as would be expected, since, like factor analysis, the clustering procedure depends upon the variables being clustered.

Using the six-cluster solution, we then conducted a descriptive analysis using a second set of variables to identify distinctive elements within clusters and characterise each of the six groups. We used one-way ANOVA and Chi-square for ordinal and nominal variables respectively (see Online Resource 8 for quantitative results). Variables

included scores for each wellbeing dimension, relevance of each wellbeing dimension, influence of the yoga practice on each dimension of wellbeing, perceptions of general health, motivation to start, keep, and stop practising yoga, and the traits of personality, gratitude, mindfulness, compassion, self-compassion, and quiet ego (see Online Resource 6 for details). Finally, we generated a bar chart to visualise key differences between clusters (see Fig. 2).

Results

Overview of Regular AYPs

Based on the descriptive analysis (Table 3), regular AYPs maintained a highly consistent practice (i.e. 7 and above), considered AY philosophy highly relevant (i.e. 7 and above), and reported practising and/or experiencing the

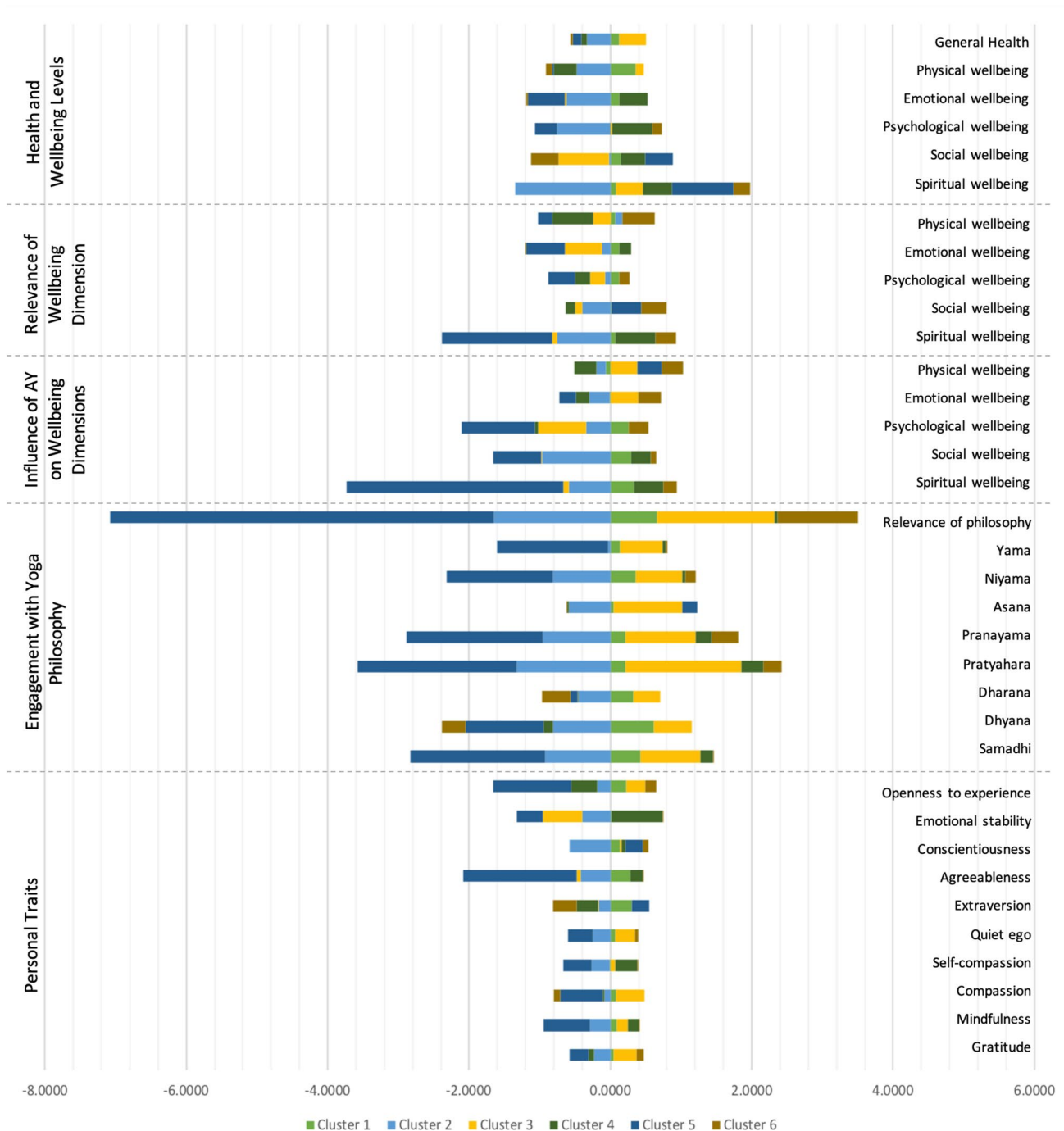


Fig. 2 Differences between clusters in terms of wellbeing, health, AY philosophy, and personal traits

Table 3 Characteristics of regular AYPs

Variable*	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Consistency of AY practice	199	7.75	1.47	2.00	10.00
Engagement with AY philosophy					
<i>Yama</i>	199	7.57	1.66	0.00	10.00
<i>Niyama</i>	198	7.17	1.63	0.00	10.00
<i>Asana</i>	198	8.87	1.52	1.00	10.00
<i>Pranayama</i>	199	8.10	1.85	1.00	10.00
<i>Pratyahara</i>	194	6.03	2.32	0.00	10.00
<i>Dharana</i>	197	7.46	1.39	3.00	10.00
<i>Dhyana</i>	196	6.56	2.02	0.00	10.00
<i>Samadhi</i>	197	5.99	2.38	0.00	10.00
Relevance of AY philosophy	199	7.76	2.28	0.00	10.00
Relevance of wellbeing dimensions					
Physical	148	9.04	1.72	0.00	10.00
Emotional	147	9.22	1.11	5.00	10.00
Psychological	146	9.21	1.18	5.00	10.00
Social	147	8.40	1.92	0.00	10.00
Spiritual	141	8.56	2.00	0.00	10.00
Wellbeing dimensions scores					
Physical	144	8.19	1.20	4.00	10.00
Emotional	145	7.52	1.45	2.00	10.00
Psychological	142	7.47	1.57	2.00	10.00
Social	142	7.11	1.97	0.00	10.00
Spiritual	137	7.3	1.68	3.00	10.00
Influence of AY on wellbeing					
Physical	148	9.04	1.72	0.00	10.00
Emotional	147	8.86	1.11	5.00	10.00
Psychological	146	9.22	1.18	5.00	10.00
Social	147	9.21	1.92	0.00	10.00
Spiritual	141	8.40	2.00	0.00	10.00
General health	127	4.13	0.72	2.00	5.00
Personal characteristics					
Big Five Personality Traits					
<i>Extraversion</i>	132	4.26	1.40	1.00	7.00
<i>Agreeableness</i>	131	4.85	1.08	1.00	7.00
<i>Conscientiousness</i>	131	5.68	1.06	1.50	7.00
<i>Emotional stability</i>	131	4.70	1.38	1.50	7.00
<i>Openness</i>	131	5.68	0.96	3.00	7.00
Gratitude	131	6.13	0.74		7.00
Mindfulness	131	3.59	0.54	3.33	4.64
Compassion	127	3.70	0.58	2.36	4.86
Self-compassion	127	3.31	0.47	1.42	4.82
Quiet Ego**		3.32		2.77	5.00

*See Online Resources 5 and 6 for details of values for each scale

**We used a modified version including 13 of the 14 items

eight elements of the philosophical framework to a considerable degree (i.e. 5 and above). *Asana* and *pranayama* were practised to a greater extent, whereas *pratyahara* and *samadhi* were practised to a lesser extent. The main motivation to start practising yoga was to improve physical and mental wellbeing and curiosity. While the main reasons why practitioners have kept practising yoga were mental, physical, and spiritual wellbeing, the main barriers to keep

practising were work commitments, followed by lack of time and experiencing acute injury (see Online Resources 3–4 and 9).

All wellbeing dimensions were regarded as highly relevant, especially emotional, psychological, and physical wellbeing. On average, practitioners reported high levels of wellbeing (i.e. 7 and above) when considering their own definition for each dimension, with physical wellbeing being the highest, followed by emotional and psychological wellbeing. Participants reported that their practice greatly influenced their wellbeing, with the largest impact being reported on physical wellbeing, followed by emotional and psychological wellbeing (see Online Resources 10–12). Overall, participants reported high levels of general health (see Online Resource 13). In terms of personal traits, the group specially recorded high levels of conscientiousness and openness to experience, along with high levels of compassion, mindfulness, quiet ego, and gratitude.

General Overview of Clusters

Here we focus on key differences between the six groups of practitioners to provide a general overview before delving into descriptions of each cluster (see Table 4). Cluster 5 was markedly distinct from the others, revealing the largest differences in several aspects from every other cluster. The main differences that we identified between clusters in terms of wellbeing were levels of spiritual wellbeing (Cluster 1 with Cluster 5), relevance of spiritual wellbeing (Cluster 2 with Cluster 5), and influence of the yoga practice on spiritual wellbeing (Cluster 4 with Cluster 5), with Clusters 5, 2, and 4 being higher on these variables, respectively.

In relation to general health, the main difference was found between Cluster 2 and Cluster 3. In terms of AY philosophy, the largest differences were between Cluster 3 and Cluster 5 in the relevance of yoga philosophy for practitioners, the experience of *pratyahara*, the practice of *pranayama*, and the experience of *samadhi*, with Cluster 6 being higher on these variables. For personal traits, the main differences between clusters were in agreeableness (Cluster 1 with Cluster 5), compassion (Cluster 3 with Cluster 5), emotional stability (Cluster 4 with Cluster 3) and openness (Cluster 3 with Cluster 5), with clusters one, three, four and three being higher on these characteristics, respectively.

Next, we present the six clusters by analysing their key features (see Fig. 2 and Online Resources 14–20 for details). Labels were created based on our interpretation of the dominant profile of each cluster. By using these labels, our aim is not to confine practitioners to a reductionistic classification but rather to organise and synthesise relevant information to illustrate different possible profiles.

Table 4 Continuous variables descriptive statistics by cluster group

Variable	Cluster 1 Mind tamers <i>n</i> = 74		Cluster 2 Not too bad <i>n</i> = 28		Cluster 3 Into philosophy <i>n</i> = 12		Cluster 4 Inner world <i>n</i> = 37		Cluster 5 critical <i>n</i> = 12		Cluster 6 average <i>n</i> = 36	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
	Consistency of AY practice	8.12	1.24	6.57	1.75	8.25	1.06	7.68	1.42	8.33	1.50	7.61
Engagement with AY philosophy												
<i>Yama</i>	7.70	1.42	7.54	1.75	8.17	1.85	7.62	1.55	6.00	2.41	7.58	1.63
<i>Niyama</i>	7.53	1.23	6.36	1.64	7.83	1.64	7.22	1.84	5.67	2.06	7.31	1.55
<i>Asana</i>	8.92	1.53	8.29	1.56	9.83	0.58	8.84	1.55	9.08	1.78	8.86	1.42
<i>Pranayama</i>	8.31	1.66	7.14	2.05	9.08	1.08	8.32	1.62	6.17	2.62	8.47	1.61
<i>Pratyahara</i>	6.25	2.22	4.70	2.63	7.67	1.56	6.35	1.95	3.78	2.68	6.28	2.08
<i>Dharana</i>	7.78	1.24	7.00	1.28	7.83	1.70	7.44	1.11	7.36	1.50	7.06	1.71
<i>Dhyana</i>	7.18	1.48	5.75	2.41	7.08	2.27	6.42	2.06	5.45	2.16	6.22	2.11
<i>Samadhi</i>	6.42	2.14	5.07	2.24	6.83	2.69	6.17	2.19	4.08	2.78	6.00	2.54
Relevance of AY philosophy	8.42	1.43	6.11	1.79	9.42	1.24	7.81	0.33	2.33	1.50	8.89	1.39
Relevance of WB dimensions												
Physical	9.11	1.61	9.14	1.31	8.80	1.48	8.46	2.58	8.83	2.04	9.50	1.11
Emotional	9.34	0.98	9.10	0.94	8.70	1.70	9.38	0.80	8.67	1.97	9.21	1.23
Psychological	9.34	1.03	9.14	1.06	9.00	1.41	9.00	1.26	8.83	1.94	9.36	1.25
Social	8.41	2.05	8.00	2.35	8.30	1.95	8.27	1.69	8.83	1.17	8.75	1.70
Spiritual	8.63	1.91	7.80	2.02	8.50	1.90	9.13	1.94	7.00	3.35	8.85	1.75
WB* dimensions scores												
Physical	8.56	1.09	7.71	1.06	8.30	0.68	7.88	1.33	8.17	0.98	8.11	1.40
Emotional	7.65	1.56	6.91	1.48	7.50	0.85	7.92	1.32	7.00	2.00	7.50	1.32
Psychological	7.47	1.71	6.71	1.45	7.50	0.71	8.04	1.20	7.17	2.14	7.61	7.61
Social	7.26	2.07	7.10	1.89	6.40	2.50	7.46	1.69	7.50	1.76	6.71	6.71
Spiritual	7.71	1.54	6.29	1.74	8.00	1.56	8.05	1.66	8.50	1.05	7.85	7.85
Influence of AY on WB												
Physical	9.26	1.67	9.19	0.93	9.70	0.68	9.00	1.66	9.67	0.52	9.63	0.88
Emotional	8.89	1.73	8.62	1.20	9.30	1.06	8.71	1.57	8.67	1.75	9.22	1.34
Psychological	9.13	1.26	8.52	1.25	8.20	3.19	8.83	1.80	7.83	3.25	9.15	0.99
Social	7.80	1.89	6.55	2.87	7.50	2.32	7.79	2.11	6.83	1.60	7.59	2.47
Spiritual	9.08	1.21	8.14	2.23	8.67	2.35	9.14	1.35	5.67	2.66	8.93	2.24
General health	4.26	0.68	3.80	0.62	4.50	0.53	4.05	0.84	4.00	0.89	4.09	0.75
Personal characteristics												
Big Five Personality Traits												
<i>Extraversion</i>	4.57	1.43	4.10	1.29	4.25	1.42	3.96	1.37	4.50	1.61	3.93	1.37
<i>Agreeableness</i>	5.14	1.05	4.43	0.91	4.80	0.75	5.02	0.96	3.25	1.70	4.86	0.93
<i>Conscientiousness</i>	5.81	0.95	5.10	1.26	5.70	0.92	5.74	1.23	5.92	0.74	5.75	1.02
<i>Emotional stability</i>	4.71	1.38	4.30	1.21	4.15	1.06	5.43	1.11	4.33	2.07	4.71	1.49
<i>Openness</i>	5.91	0.82	5.50	0.97	5.95	1.01	5.31	0.93	4.58	1.16	5.84	0.96
Gratitude	6.17	0.74	5.89	0.91	6.45	0.57	6.05	0.86	5.86	0.63	6.23	0.47
Mindfulness	3.78	0.50	3.41	0.44	3.86	0.55	3.86	0.62	3.04	0.38	3.70	0.47
Compassion	3.99	0.45	3.82	0.73	4.32	0.46	3.89	0.74	3.30	0.96	3.83	0.60
Self-compassion	3.32	0.53	3.07	0.52	3.39	0.47	3.64	0.53	2.91	0.77	3.33	0.66
Quiet Ego	3.98	0.41	3.65	0.31	4.18	0.46	3.90	0.60	3.55	0.68	3.94	0.39

*WB, wellbeing

Cluster 1: The Mind Tamers

Cluster 1 was the largest cluster, including 74 regular AYPs. They were more likely to have a regular practice ranging from three to fifteen years. Most practiced at the yoga studio *shala* with a teacher or by themselves at home. They typically practiced for 80 to 120 min, full primary series

up to half intermediate series. They were also more likely to include resting days following AY tradition, chant opening and closing mantras, and doing *pranayama* at the beginning or end of the practice. From the eight limbs of yoga, they reported experiencing *dhyana* (meditation) to a greater extent. They regarded yoga philosophy as relevant and

tended to either not identify strongly with any spiritual tradition or deemed themselves as atheist or agnostic.

This group tended to regard psychological wellbeing as highly relevant and reported the highest scores of physical wellbeing amongst the group of practitioners. They estimated that their yoga practice particularly influenced their psychological and social wellbeing. Interestingly, they presented lower levels of spiritual wellbeing, but estimated that their yoga practice had a positive influence in that dimension. They also had the highest scores in extraversion and agreeableness, and were more likely to have experienced depression in the past.

This group appeared to represent seasoned practitioners with an established asana practice who had been able to overcome mental health challenges and steady their mind through practising or experiencing meditation. Their psychological functioning appeared to be fundamental to them, and although they experienced the highest levels of physical wellbeing compared to other clusters, they noted that the practice had a larger contribution to their psychological wellbeing. Their extraverted and agreeable nature may relate in some way to their perception of the yoga practice contributing to their social wellbeing.

Cluster 2: Not Too Bad

A total of 28 regular AYPs formed Cluster 2. They were more likely to practise to a lesser extent and were less consistent compared to the other groups. They had a regular practice for less than three years and typically practised half to full primary series between 3 and 4 days for sessions of 40 to 80 min. They were less likely to practice in the Mysore style format, to attend traditional Sanskrit-counted led classes, to rest as per AY tradition, and more likely to be practising with three or more teachers. They were also less prone to use free breathing with sound throughout the practice or to include pranayama at the start or end of the practice. Their engagement with yoga philosophy was lower than other groups (i.e. once a month or less). They were prone to identify themselves as atheists or to not identify with any spiritual tradition.

They reported the lowest general health score and, although they scored less than average on every wellbeing, health, and personal traits measure, they were not at the bottom end. They reported the lowest wellbeing scores in all dimensions when compared to the other groups, except social wellbeing, with the highest levels amongst practitioners. They were also more likely to have experienced or be experiencing anxiety and depression. They were more likely to be motivated to start practising to improve mental wellbeing and physical wellness, as well as for curiosity, and more likely to stop practising because of lack of motivation, time, or work commitments.

This cluster appeared to represent a group of less experienced practitioners who practised less frequently and

probably struggled with motivation and time to sustain the practice. Their perception of lower levels of health and wellbeing as well as experiencing mental distress seemed to align with their motivation to improve those areas through the practice. The seemingly under-engagement with yoga philosophy, the low frequency of practice, and the less likelihood of including breathing techniques and resting may relate to their perceptions of lower levels of health and wellbeing.

Cluster 3: Into Philosophy

Cluster 3 grouped 12 regular AYPs who were likely to identify with Hinduism as a spiritual tradition. They considered yoga philosophy more relevant than other groups and tended to engage almost daily with it, practising to a greater extent seven of the eight limbs of Patanjali's yoga. Here, practitioners were more likely to practice at home a modified *asana* sequence, engage in AY-based guided classes, and practice another type of yoga alongside AY. They also tended to include more *pranayama* and meditation at the start and/or at the end of their practice, and all of them included *drishti* and *bandhas* during their practice. From the eight limbs, they were more likely to experience *pratyahara* and *samadhi* to a higher extent when compared to other clusters.

They reported the lowest scores on social wellbeing and higher levels of physical and emotional wellbeing (after Clusters 1 and 4 respectively), and estimated that the practice positively influenced their emotional and physical wellbeing to a great extent. They tended to have the highest levels of general health, gratitude, mindfulness, compassion, quiet ego, and openness. They were more likely to have experienced anxiety in the past and to have started practising yoga for mental wellbeing and healing trauma.

While more aligned with yoga philosophy, this group appeared to represent less dogmatic practitioners, who were more flexible with the asana practice and more open to engage in a range of yoga philosophy activities. Their perception of the positive influence that the yoga practice has had on their emotional and physical wellbeing seemed to be aligned with positive personality traits and overall health. These positive traits could relate to some extent to their exposure to yoga philosophy and Hinduism.

Cluster 4. Into the Inner World and Beyond

Cluster 4 included 37 regular AYPs who tended to practice full primary series combining a Mysore style format with traditional Sanskrit-counted led classes. Along with Cluster 1, they were more likely to chant opening and closing mantras in their practice. They were more prone to identify with Christianity or Buddhism as a spiritual tradition. They were very

likely to engage with chanting mantras as a way to practice yoga philosophy, as well as more likely to attend after-class conferences with their yoga teacher. They tended to practice at a *shala* with one main teacher and another teacher.

This group highly regarded emotional and spiritual wellbeing, and had the highest levels of emotional and psychological wellbeing. They also had the highest levels of social and spiritual wellbeing after Cluster 5. They tended to estimate that the practice positively influenced their spiritual wellbeing to a greater extent compared to other groups, and were more likely to have started practising yoga for spiritual wellbeing. They displayed the highest scores in self-compassion and emotional stability. Interestingly, they were also more prone to have experienced allergies and asthma.

This group appeared to present alignment and coherence within the spiritual dimension, in terms of perceiving high levels of spiritual wellbeing, being highly relevant to their lives, and perceiving it as the main driver and outcome of the practice. This cluster also seemed to have a defined spiritual path by aligning with specific spiritual and religious traditions, and by seeking and cultivating spiritual wellbeing through a yoga practice clearly grounded in the traditional AY method with one main teacher. Their engagement with chanting mantras inside and outside the practice may be a way of connecting with themselves and their spiritual dimension. The traits of emotional stability and self-compassion may indicate their connection to their inner world and their perception of the relevance of emotional wellbeing, as well as the experience of high levels in this dimension.

Cluster 5: The Critical Ashtangis

Cluster 5 grouped 12 regular AYPs who were highly likely to only practise Mysore style and/or traditional Sanskrit-counted led classes in an AY *shala*, with one or two teachers. Their practice tended to include longer sessions (i.e. up to 120 min), more likely to comprise both full primary and intermediate series. Compared to other groups, they reported the highest levels of consistency in their practice. All practitioners from this group included *vinyasa*, free breathing with sound and *bandhas* throughout their practice. They did not regard yoga philosophy as relevant and tended to practise five out of the eight limbs (i.e. *yama*, *niyama*, *pratyahara*, *dhyana*, *samadhi*) to a lesser extent. They were less prone to engage with yoga philosophy, especially in the forms of yoga teacher training or online yoga courses. They were less likely to engage in chanting mantras and practise meditation before or after the practice. They identified as either atheist or agnostic, or did not identify with any spiritual tradition.

Although they considered that the practice did not influence spiritual or social wellbeing to a significant extent and that it was unlikely they would keep practising for spiritual reasons, they had the highest levels of spiritual and

social wellbeing across clusters. While they considered emotional, psychological, and spiritual wellbeing less relevant compared to other groups, they highly valued social wellbeing. The Critical Ashtangis had the lowest levels of gratitude, mindfulness, compassion, self-compassion, quiet ego, agreeableness, and openness to experience amongst practitioners. Interestingly, they also had the highest levels of conscientiousness.

This group of practitioners appeared to be more critical, practical, self-centred, and asana oriented compared to the other clusters. Their high levels of conscientiousness may be expressed in their perseverance, adherence, and dedication to their yoga practice. The high levels of conscientiousness and the long-term established practice, along with the lack of engagement with yoga philosophy, may speak to yoga being practised as a healthy habit rather than a lifestyle underpinned by yoga principles.

Cluster 6: The Average Autonomous Ashtangis

The 36 regular AYPs included in Cluster 6 were more likely to practise on their own, or in a Mysore style format if travelling to practise with their teacher. Their practise typically consisted of full primary up to half of intermediate series during sessions of 60 to 80 min. They were more likely to chant opening and closing mantras, engage in yoga philosophy daily, and include a greater variety of ways to learn about yoga philosophy, particularly reading books, chanting other mantras and texts, watching videos online, reading blogs, and following social media. In terms of the extent of the practise or experience of the eight limbs of yoga, they were closer to the average of the sample.

They tended to regard physical and psychological wellbeing as extremely relevant and considered that their yoga practice positively contributed to their psychological wellbeing. After Cluster 4, they presented the highest levels of emotional and psychological wellbeing. They tended to revolve around the average scores within the sample included in this study, reporting average scores across the dimensions of wellbeing and in general health. Like the *Into Philosophy* group, they considered philosophy highly relevant, and similar to the *Not Too Bad* group, they also tended to consider social and spiritual wellbeing more relevant compared to other clusters. Interestingly, they reported higher levels of introversion and were more likely to identify with Christianity or Buddhism as spiritual traditions. They also were more likely to keep practising in the future due to a calling and consider stopping practising because of acute injuries.

This group appeared to represent seasoned and more autonomous practitioners who valued the physicality of the practice as well as physical wellbeing. Still, they seemed to highly regard philosophical elements and to acknowledge the

positive impact that the practice had in terms of psychological wellbeing. The fact that their scores were closer to the average of the group might mean that their evaluations were more balanced across the various domains assessed.

Discussion

We identified six groups of regular AY practitioners, examined their profiles, and explored differences in terms of their yoga practice, health, wellbeing, motivations, and personal attributes. The six groups of practitioners differed in the type of engagement with the physical, mental, and spiritual aspects of the yoga practice, and in the dimensions of wellbeing that were reported as being impacted the most. Identifying and understanding different types of long-term practitioners allow for a better comprehension of how people harness specific elements of the practice to create wellbeing according to their needs. Knowing about these differences can benefit yoga researchers, practitioners, and facilitators to better understand yoga practitioners' characteristics and needs to foster meaningful areas of wellbeing while supporting and sustaining their practice. In this section, our aim is to further discuss our findings by focusing on wellbeing dimensions to discuss patterns across the six groups of practitioners, with the purpose of understanding which elements relate to each dimension. Lastly, we discuss theoretical and practical implications, as well as limitations and future directions.

Findings show that participants shared many similarities and represented a mostly homogeneous group. This might be partly due to including practitioners of one yoga tradition. Regular AY practitioners generally had high levels of general health and of physical, emotional, and psychological wellbeing. Furthermore, they deemed these wellbeing dimensions as the most relevant and the most positively influenced by their yoga practice. These findings are consistent with research showing that yoga practitioners tend to report higher levels of wellbeing compared to the general population and to endorse positive impacts of yoga on health and wellbeing (Cartwright et al., 2020; Cramer et al., 2019; Penman et al., 2012; Ross et al., 2013). Overall, AY practitioners were likely to practice frequently and consistently, within an autonomous setting (i.e. Mysore style, home practice). Past research shows that the frequency of autonomous practice predicts subjective wellbeing (including emotional, psychological and social dimensions) and healthier lifestyles, as well as physical and mental health (Cartwright et al., 2020; Cramer et al., 2017b; Ross et al., 2012; Sibbritt et al., 2011). It is possible that the autonomy fostered by the AY method, a distinctive feature of this yoga style, may play a key role in sustaining a self-practice and cultivating wellbeing. Autonomy and autonomy support are widely acknowledged in the academic literature as essential for

promoting intrinsic motivation, self-determination, behaviour change, and wellbeing (Mossman et al., 2024; Pérez-González et al., 2019). Furthermore, the individuality of the yoga practice has been considered a potential mechanism of change in the context of yoga therapy (Harvey et al., 2020). Thus, the autonomy component in the AY method might hold a key for other forms and contexts of yoga.

In terms of personality traits, regular AY practitioners had high levels of conscientiousness and openness to experience. This aligns with studies finding associations between conscientiousness and the openness facets of need for cognition (an aspect of creativity), and the lack of need for closure (McCrae & Sutin, 2009), which may be more common in regular AY practitioners. This might be partly explained by the nature of the practice. On the one hand, the AY practice is based on a structured method encouraging discipline, consistency, and regularity in terms of the frequency of the practice. While this may appeal more to conscientious people, the yoga practice itself may cultivate the trait, as demonstrated by previous research (e.g. Chokalingam & Kumari, 2015; Yadav et al., 2015). On the other hand, yoga and AY in particular can foster higher levels of awareness in terms of physical sensations, emotions, and thoughts, as well as teach people to observe their experience with curiosity and acceptance. This is consistent with studies reporting increased levels of conscientiousness and openness to experience in participants after practising yoga (Bright et al., 2021; Yadav et al., 2015). Still, it may also be possible that people with high levels of openness to experience are drawn to this type of practice, since yoga can offer an avenue for self-exploration and transformation (Barkan et al., 2016). Indeed, a high proportion of yoga practitioners in this study stated that one of their main motivations to start practising was curiosity for the practice, which is a facet of openness. Thus, there is a possibility of a bidirectional relationship that would need to be explored in future research.

This group of practitioners also displayed high levels of compassion, mindfulness, quiet ego, and gratitude. The healthy balance between being centred in oneself and being centred in others (i.e. quiet ego) entails both heightened awareness and compassion (Bauer & Wayment, 2008). Previous research has shown that a regular yoga practice is associated with higher levels of mindfulness, which entails heightened awareness (Cartwright et al., 2020; Ross et al., 2012, 2013). The cultivation of observance along with an attitude of acceptance throughout a regular yoga practice may facilitate the strengthening of a quieter ego, and thus explain these characteristics (Conboy et al., 2010). Similarly, gratitude is positively correlated with years of yoga practice (Ivtzan & Papantoniou, 2014) and can increase after participating in a yoga program (Ahmadi et al., 2016). Based on previous research examining mechanisms of change in yoga (e.g. Harvey et al., 2020; McCall, 2013; Menezes et al.,

2015; Tihanyi et al., 2016), as well as practitioners' perceptions (Kishida et al., 2018), it is possible that enhanced levels of these traits can be attributed to the practice. However, more research clarifying these relationships is needed before drawing conclusions.

In terms of motivation, several trends echoed previous research. For instance, most practitioners reported having started practising yoga and maintaining a regular practice due to physical wellness and mental wellbeing (e.g. Cartwright et al., 2020; Kramer-Kostecka et al., 2022) and developed motivations to practise for spiritual wellbeing (e.g. Genovese & Fondran, 2017; Ivtzan & Jegatheeswaran, 2015). This evolution may represent the experience of the holistic nature of yoga and the benefits in different dimensions of human functioning (Cramer et al., 2019). However, as noted in previous research, change trajectories should be further explored by investigating the evolution of practitioners and their practice throughout time. In summary, while the characteristics of regular AY practitioners are in some ways consistent with previous research on yoga in general, other characteristics may relate to specific elements of AY. Next, we focus on the differences between AY practitioners and further discuss the wellbeing patterns across the six clusters of practitioners.

Our cluster analysis revealed interesting differences between regular AY practitioners in terms of their perceptions of health and wellbeing, their yoga practice, and personality traits. Some clusters from this study partly mirror clusters found in previous research. For example, *The self-helpers* and *The mystics* described by Henrichsen-Schrems and Versteeg (2011) share features with the *Into Philosophy* (healing motivations) and the *Into the Inner World and Beyond* (spiritual, ethical, philosophical interests) clusters. Furthermore, *The yogis* described by Cagas et al. (2022b) encapsulate the connection to psycho-spiritual elements and the high levels of yoga immersion found in these two clusters. And while *The exercisers* described by the same authors speak to the emphasis on physicality and less interest in psycho-spiritual elements found in *The Critical Ashtangis*, *The postural yogis* (Cagas et al., 2022b) align with the *Average Autonomous Ashtangis* in their equal regard for physical and spiritual facets while maintaining interest in mental and philosophical elements of the practice. These overlaps suggest that regardless of their yoga tradition, regular practitioners may be grouped according to their differing interests in the physical, psychological, spiritual, and philosophical elements of yoga.

Clusters from our study support and expand previous research. We have described how participants practised AY in particular ways and for different reasons, as well as their different levels of engagement with philosophy, and their perceptions of which dimensions of wellbeing were being positively impacted the most. Here, we focus on this latter

aspect by looking at each dimension of wellbeing in relation to common patterns between the clusters of practitioners.

Physical wellbeing was highly valued by all groups of practitioners. *The Mind Tamers* (Cluster 1) and *Into Philosophy* (Cluster 3) clusters displayed the highest levels of physical wellbeing, while the *Into Philosophy* (Cluster 3) and *The Critical Ashtangis* (Cluster 5) clusters believed that this dimension of wellbeing was the most impacted by their yoga practice. Strikingly, the two latter groups were seemingly complete opposites. They had the greatest differences in their levels of gratitude, mindfulness, compassion, quiet ego, and openness to experience, as well as having marked differences in their relation to yoga philosophy. This indicates that physical wellbeing may be a dimension of wellbeing that is commonly perceived as being influenced by the yoga practice regardless of practitioners' personal characteristics and beliefs. This is consistent with previous research demonstrating that practitioners' primary motivation to start doing yoga is physical health and physical fitness (Cartwright et al., 2020; Cramer et al., 2019; Kramer-Kostecka et al., 2022; Telles et al., 2017). Allowing people to experience yoga as a physical practice may constitute a highly important element to consider, as it may be a way to gauge interest and motivation to open up a gateway to access other benefits and dimensions of the practice.

Furthermore, despite the differences between these clusters, they commonly included breathing techniques before, during, and/or after their practice, and maintained a vigorous (especially Clusters 1 and 5) and autonomous practice, tailored to their needs. Thus, physical wellbeing may emerge not only from the strengthening, flexibility, and balance of the musculoskeletal system by performing certain *asanas* (e.g. Gruber, 2008), but also from balancing the autonomic nervous system through breathing techniques (e.g. Tyagi et al., 2016). Hence, the combination of motivations towards improving physical wellness with the practice of physical postures and breathing techniques seems central for enhanced physical wellbeing.

Emotional wellbeing was higher amongst participants in the *Into The Inner World And Beyond* (Cluster 4), followed both by the *Into Philosophy* (Cluster 3) and *The Average Autonomous Ashtangis* (Cluster 6) groups. However, the latter two clusters were the ones who perceived that their yoga practice impacted this wellbeing dimension to a higher extent. There were several trends across these three clusters of practitioners: they were more likely to identify with a particular spiritual tradition (i.e. Buddhism, Christianity, Hinduism), they highly valued the spiritual dimension of wellbeing, and their engagement with yoga philosophy was higher than other groups. Previous research has proposed that spiritual teachings may play a key role in reappraisal strategies, which may facilitate emotion regulation in yoga practitioners (Menezes et al., 2015), in turn contributing to

emotional wellbeing. Indeed, emotion regulation has been considered a mechanism of change in yoga therapy (Bennetts, 2022), and research has shown that yoga practitioners can regulate their emotions by using attentional awareness and reduced egocentric bias as distinct pathways (Wadden et al., 2018). This may speak to specific abilities or traits linked to the practice.

Interestingly, the three clusters practised different *asana* sequences in different modalities, while also displaying enhanced levels of different personal traits (i.e. gratitude, self-compassion, emotional stability, introversion). Gratitude has been found to be positively associated with the yoga practice (Ahmadi et al., 2016; Ivtzan & Papantoniou, 2014) and self-compassion has been proposed as an outcome (Crews et al., 2016) and a potential pathway by which yoga generates health and wellbeing benefits (Cox & Tylka, 2020). Thus, gratitude and self-compassion, in addition to the self-study of yoga philosophy (i.e. *yama* and *niyama* according to Bennetts, 2022) and pre-existing spiritual beliefs, may play an important role in cultivating emotional wellbeing. Furthermore, emotion regulation is related to emotional stability, which has been shown to predict emotional wellbeing (Bujor & Turliuc, 2014) and may be enhanced through the practice (Barkan et al., 2016).

Psychological wellbeing was perceived as the main wellbeing dimension that was positively impacted by the yoga practice, according to *The Average Autonomous Ashtangis* (Cluster 6) and *The Mind Tamers* (Cluster 1), with the latter group also reporting the highest levels of wellbeing in this dimension. Practitioners across these two groups were long-term established practitioners who mostly practised the same *asana* sequence (i.e. full primary up to intermediate series), and who most highly regarded yoga philosophy after *the Into Philosophy* (Cluster 3) group. This may indicate the relevance of developing a steady long-term yoga practice underpinned by philosophy for the improvement of psychological wellbeing (Gaiswinkler & Unterrainer, 2016).

While *The Mind Tamers* were more extroverted, *The Autonomous Average Ashtangis* were more introverted. Yet, both were able to experience the benefits in the psychological dimension. One possible explanation is that the AY method enables people to develop and sustain their own practice, whether that is in a group or a solo setting, allowing practitioners to choose what best suits their needs. Hence, the combination of a steady *asana* practice grounded in philosophy with a practice setting matching practitioners' needs appears to be central for fostering psychological wellbeing.

Social wellbeing and *spiritual wellbeing* were perceived as being impacted by the yoga practice to a higher extent by *The Mind Tamers* (Cluster 1) and *The Into The Inner World And Beyond* (Cluster 4). The latter cluster and *The Critical Ashtangis* (Cluster 5) reported higher levels of wellbeing in both dimensions as well. These three groups do

not seem to share many features, besides practising mostly the same *asana* sequence (i.e. full primary series), practising at a *shala* in a group setting, and attending traditional Sanskrit-counted led classes. The preference for practising in a group setting might constitute a relevant factor for social wellbeing, since practising with others can bring a sense of connectedness and belonging to a likeminded community (Ross et al., 2013). Similarly, the shared ritual of regularly attending traditional Sanskrit-counted led classes (which usually happens after mastering a portion of primary series) may foster a sense of connection to the AY tradition and the yoga framework, which may contribute to cultivating spiritual wellbeing. For *The Mind Tamers* (Cluster 1) in particular, higher levels of social wellbeing could be explained by the higher levels of extraversion and agreeableness, which have been identified as divergent pathways to increased satisfaction with social relationships (Tov et al., 2016). Thus, while some practitioners may have these personal traits, the community-based aspects of AY seem to play a central role in fostering social wellbeing.

Overall, practitioners in this study reported higher levels of wellbeing and a greater impact of the practice in the physical, emotional, and psychological dimensions. Research has proposed that a regular yoga practice may facilitate intrapersonal changes first, which then overflow into the interpersonal realm (Kishida et al., 2018). This would mean that practitioners may take longer to experience the impact in the social dimension. A similar issue may happen with spiritual wellbeing. Different studies have shown that practitioners shift their motivations and perceptions of the impact of the practice, evolving from physical and mental purposes towards the cultivation of spirituality (Büssing et al., 2012; Cramer et al., 2019; Ivtzan & Jegatheeswaran, 2015; Park et al., 2016). It is worth noting that perceptions of lower levels of wellbeing and reduced impact of the practice on wellbeing were consistently reported by the same group of practitioners: *The Not Too Bad* (Cluster 2). Their level of engagement with the practice in terms of frequency, consistency, and yoga philosophy may indicate that the level of involvement could be a crucial element for enhancing wellbeing (Gaiswinkler & Unterrainer, 2016). This study has shown how practitioners display different profiles in terms of their yoga practice, health, wellbeing, and personal attributes, and discussed common elements between practitioners with high levels of physical, emotional, psychological, social, and spiritual wellbeing. Findings from our cluster analysis have both practical and theoretical implications.

Firstly, the relevance of acknowledging yoga as a multifaceted and integrative practice involving different aspects of the individual cannot be overstated. The holistic nature of yoga and other body-mind practices may offer more diverse benefits compared to other forms of either physical, mental, or spiritual practices on their own, since they may act in

tandem by addressing one area that can influence other areas as the practice evolves over time (Cagas et al., 2022a, 2022b; Ross et al., 2012). At a practical level, knowing how and why people practice, as well as learning about differences and similarities in their wellbeing profiles and personal characteristics can allow yoga facilitators to design the best route to target the main area of interest of the yoga practitioner, while providing support and mapping ways in which that can overflow to other areas to amplify and consolidate changes. Knowing their motivation to practice and what aspects of wellbeing people value the most can allow yoga facilitators and wellbeing practitioners to consider leverage points to catalyse sustainable change. Leverage points represent areas that require minimal shifts or efforts to generate significant change within a system (Meadows, 1999). Looking at the individual as a system, initiating a shift in one wellbeing area or aspect of the practice can potentially cascade onto others.

Another practical implication derives from the ways in which practitioners made the practice work for their own needs. *The Autonomous Average Ashtangis* were more introverted, and they tended to practice at home on their own and met with their teacher whenever possible. *The Critical Ashtangis* highly regarded social wellbeing and preferred to practice in a yoga studio, and the *Into Philosophy* group were more likely to adapt their asana practice to their individual context. By knowing this information, practitioners may be able to intentionally and mindfully craft their practice to their own needs and circumstances, instead of feeling overly attached to what their practice should look like at all times. Similarly, teachers can promote practitioners' autonomy by helping them tune into these subtleties and supporting them to develop a sustainable practice as they evolve.

Finally, the theoretical implications of this research relate to the personal traits included in this study (i.e. mindfulness, self-compassion, quiet ego, emotional stability) being intricately intertwined. The quiet ego encompasses mindfulness and compassion. Mindfulness is fundamental to developing other traits, and self-compassion is needed to cultivate compassion, while certain personality traits seem to be trainable with yoga. Previous research has recommended focusing on personality traits in relation to seeking holistic practices such as yoga, and to study changes in these traits after a long-term practice (Vergeer et al., 2021). This study further exposes the dynamism and complexity of the relationships between personal traits, which can be considered outcomes, predictors, or mechanisms of change, depending on the focus of the research. Hence, this research raises the need for understanding these relationships within a more comprehensive approach, both in terms of research and the development of a conceptual framework.

Limitations and Future Directions

Several limitations of the current study must be acknowledged. Firstly, our findings only represent a particular group of AY practitioners and do not necessarily represent all AY practitioners. Although not generalisable, findings add to the existing literature on yoga practitioners in general, and specifically AY practitioners, as they mirror other more representative studies of yoga practitioners in the West. Secondly, similar to previous research, most practitioners included in the study were middle-aged and highly educated women living in Westernised contexts, which means that characteristics of the sample may have influenced the results. While this may reflect that yoga is mostly practised by people with such characteristics, it can also mean that it has been more accessible to this type of population, or that studies have failed to include a broader variety of practitioners, mainly due to self-selection reasons. Thirdly, while our research design allowed us to understand the profile of yoga practitioners, the study is descriptive in nature and used cross-sectional and self-report measures. Thus, we cannot draw causal relationships between variables to further explain our findings. Fourthly, we did not analyse the potential impact of demographic variables such as age and years of practice. Further analyses might test the plausibility of the analyses with potential confounding factors.

Finally, other limitations were closely associated with the survey length and design, including missing data and variables with unequal binning. Although *k-means* clustering excluded participants with missing values, variables used for cluster description did include missing data. While this did not affect clustering and missing data were distributed across clusters, it might have affected how these variables were represented in each cluster. These missing values can be attributed to the length of the survey and participants' burden, as the response rate decreased in the second half of the survey. This may also imply that people with certain characteristics tended to complete the survey (e.g. high conscientiousness), though it is not possible to determine. On the other hand, while the choice of collecting data using unequal binning for some variables (e.g. years of practice, age) was based on reducing participants' burden due to the length of the survey, it presented the limitation of exploring differences within these variables in more detail and whether this might have impacted the cluster formation. Still, we believe that our study makes a relevant contribution to understanding the relations between the practice of yoga and wellbeing in regular practitioners. Further consideration of the aforementioned limitations opens up the door for future research to address these gaps.

Future investigation should examine the development of personal traits such as mindfulness, self-compassion, and quiet ego, through the practice of yoga and their interactions, to unravel the pathways towards wellbeing and identify what is their role in the yoga practice to facilitate changes in wellbeing. Applying a systems approach to research these interactions could address

processes and complexities to offer a more comprehensive understanding of changes in individual characteristics. The use of mixed-methods designs could allow incorporating the relationships between variables and the richness of people's lived experiences in informing how those relationships take shape.

Furthermore, longitudinal studies are essential for examining the evolution of the practice and how people tailor their practice throughout time, potentially identifying specific trajectories in which yoga practitioners cultivate certain abilities and generate transformational changes for themselves. This type of research can also help clarify whether different types of practitioners (i.e. clusters) evolve into different groups, which can be relevant for developing yoga programmes. Another aspect for further exploration and addressing methodological limitations from this study is assessing demographic effects on variables such as AY practice frequency and length of the practice. This can be done by collecting nominal data using equal binning or by gathering ordinal data.

Finally, future investigation should advance the access of the practice to more diverse audiences. Yoga is often thought of as a practice that can only be done at a studio or following the instructions of a teacher, instead of an autonomous practice. Encouraging people to take ownership of their practice while providing them with the tools and support they need may help dissolve potential barriers that curb yoga to a particular segment of individuals. Research could focus on trialling yoga programmes which encourage and support people to learn and develop a yoga practice that meets their needs in an autonomous and accessible manner.

Conclusion

Our study examined how perceptions of wellbeing varied across regular AYPs, depending on practitioners' characteristics, and whether regular AY practitioners had unique profiles depending on their expertise with yoga. Overall, we found that practitioners' perceptions of wellbeing were similar in terms of experiencing high levels of wellbeing and believing that the physical, emotional, and psychological dimensions of wellbeing were more relevant to them and positively impacted by their yoga practice. However, we distinguished six groups of practitioners who differed from one another in terms of their practice, personal characteristics, and wellbeing profiles. Our findings suggest that beyond the years of practice and the AY *asana* sequence, different types of engagement with a range of physical, mental, and spiritual aspects of the yoga practice are what make the difference.

By looking at each dimension of wellbeing, it was possible to identify key elements in practitioners that are potentially relevant to consider when designing sessions that may target such dimensions. Physical wellbeing seems to be the entry

point for most practitioners and a gateway to experience further benefits. While gratitude, self-compassion, and emotion regulation appear to play a fundamental role in emotional wellbeing, long-term practice in combination with yoga philosophy engagement seems to be central for psychological wellbeing. Examining the mechanisms of yoga in relation to health and wellbeing, while advancing conceptual models trying to capture the dynamism and complexity of elements involved in the yoga practice, will allow us to keep advancing yoga research and practice towards more inclusive and holistic worldviews.

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Data Availability Relevant data has been included in the supplemental materials (online resources). In compliance with ethics approval, data can be shared upon request to be used in closely related projects.

Declarations

Ethics Approval All procedures included in this research were approved by the University of Melbourne's Human Research Ethics Committee (protocol #1955377.1).

Informed Consent Participants were provided with a plain language statement and informed consent was required prior to participation in this study.

Conflict of Interest The authors have no conflict of interest to disclose or any competing interests to declare that are relevant to the content of this article. The lead author is a regular Ashtanga yoga practitioner. This study was not conducted in the interest of any Ashtanga yoga studio, teacher, school, or association, nor in the interest of Sharath Yoga Centre in Mysore, India.

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