

The Relationship Between Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning Among Adults

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Abstract

Protective factors in the face of adversity have been studied, post-covid, to investigate the decline and maintenance of cognitive functioning. Resilience, grit, and psychological hardiness have been found to be predicted by cognitive flexibility and executive functioning, yet studies also suggest the importance of hardiness as a trait, and stimulation of cognitive processes in maintaining cognitive functioning. This research will study the relationship between psychological hardiness, cognitive flexibility, and cognitive functioning in young and older adults. It is hypothesized that psychological hardiness and cognitive flexibility are significant predictors of cognitive functioning. 150 young adults and 138 older adults were sampled using non-proportional quota sampling. Pearson's correlation analysis, t-tests, and multiple linear regression analyses were used to statistically analyze the variables and determine their relationship. Higher levels of hardiness were associated with higher levels of cognitive flexibility, where cognitive functioning was negatively correlated with both the variables. Psychological hardiness and cognitive flexibility were found to be significant predictors of cognitive functioning in both young adults and older adults. However, due to the inverse relationship between the constructs, an in-depth study of dynamics of predictability and association is impertinent. Factors such as cognitive stimulation manifested in active social engagement and lifestyle choices have implications in assisting individuals to cope with cognitive ageing, and for holistic health interventions and social services in the culturally specific context of Pakistan.

Keywords: Psychological hardiness, resilience, cognitive flexibility, cognitive functioning, ageing, regression, cognitive stimulation

1. Introduction

Human survival depends on cognitive functioning, and the topic of cognitive decline with age has received much attention in both scientific and societal contexts (Barbara et al., 2020; Bergeman, 2007). As people age, their cognitive capacities vary gradually leading to differences in cognitive abilities in different age groups presented with the same situation (Bergeman, 2007). These changes can take many different forms and have an effect on a person's daily life and general wellbeing (Harada et al., 2013). Additionally, with the array of problems an individual receives exposure to, a commitment to cope, flexibility and overall, a skill to alter viewpoint, especially under pressure and hardship prove essential for coping and perseverance (Holahan, 2017). The

importance of psychological hardiness and cognitive flexibility in the context of perceived cognitive functioning in different age groups becomes clear in this situation. Understanding the relationships between these psychological concepts and how they change with age will help us better understand the intricate dynamics of cognitive ageing and resilience.

1.1 Psychological Hardiness

On a broader level, psychological hardiness can be referred to as a collection of attitudes that provide people the courage and motivation needed to develop the skills and techniques necessary to shift stress—including the stress caused by possible disasters or illnesses—into chances for personal growth (Maddi, 2006). The conceptual definition for the study focuses on psychological hardiness as a personality trait that empowers individuals to effectively navigate and endure challenging life circumstances. Kobasa (1979) suggested that hardy individuals are better equipped to withstand the impact of stressful life situations because they exhibit particular emotional, cognitive, and behavioral responses. Psychological hardiness comprises three core components. The first element is commitment, which reflects a strong engagement with life and a genuine curiosity about the world. The second component is control, specifically emphasizing an internal locus of control, where individuals believe that their actions and beliefs can influence their surroundings. The third aspect is challenge, which encompasses a willingness to adapt, change beliefs, and seek personal growth in the face of adversity (Kobasa 1979; Maddi 2006). Conversely, individuals lacking psychological hardiness may exhibit a lack of commitment, tend to lean towards an external locus of control, and may resist change in their lives (Kobasa, 1979).

1.2 Cognitive Flexibility

Cognitive flexibility refers to an individual's awareness of the possibility of alternatives, a willingness to adapt to a situation, and a belief in their capacity to be flexible (Martin & Rubin, 1995). Martin and Rubin (1998) stressed the importance of these components stating that self-efficacy is an important element of cognitive flexibility. Dennis and Vander Wal (2010) define cognitive flexibility as an adaptive skill that assists individuals in encountering stressful situations by preventing the individual from engaging in dysfunctional patterns of thinking. It focuses on the mental agility to switch between different cognitive sets, perspectives, or problem-solving strategies, and to modify existing cognitive structures to accommodate new information or situations (Davidson et al., 2006; Dennis & Vander Wal, 2010; Scott 1962). There are two main components of cognitive flexibility: perception of multiple alternatives, solutions and perspectives, and an internal locus of control (Dennis & Vander Wal, 2010). While cognitive flexibility is characterized by an individual's capacity to shift from one cognitive approach to another in response to changing task requirements (Scott, 1962), it is their internal locus of control and self-efficacious belief to bring about the desired change that weigh heavier in the components (Dennis & Vander Wal, 2010; Martin & Rubin, 1998).

1.3 Cognitive Functioning

Broadly, cognitive functioning is recognised as a culmination of different mental abilities including thinking, reasoning, memory, learning, attention, problem solving, and decision making (Fisher et al., 2019). The construct relies on the assumption that the conceptualisation of cognitive functioning is supported by the definition and measurement of quantifiable cognitive abilities such as intelligence, visuo-constructional abilities, perception, language amongst other mentioned cognitive abilities (Fisher et al, 2019). In the current study, cognitive functioning will be studied on a perceptual level, i.e., individuals' own perception of their cognitive functioning. Annunziata

et al. (2012) contextualise cognitive functioning as a component of quality of life (QoL) measuring a series of mental processes including memory, attention, executive functions, language, and perception. Focusing on a holistic approach to health in their study, they aimed to provide an assessment for cognitive functioning in non-clinical populations to promote the overall bio-psycho-social well-being model advocated by World Health Organisation (WHO).

There are consistent overlaps in the definitions and applicability of these phenomenon. The research aims to investigate an individual's belief in their capacity to accept challengers, identify and select alternatives, adapt, and solve a problem, looking into how that could potentially be related to their perception of cognitive functioning.

2. Literature Review

2.1 Psychological Hardiness

At the initial conceptualisation stages of trait hardiness, it was measured as component of resilience towards illness and related onset of stressful events and was found to be a key predictor of decreased stress and better coping (Kobasa, 1979; Kobasa et al., 1982). The traits of psychological hardiness have been studied with other personality traits such as life satisfaction, resilience, etc. Hardiness and resilience were found to be closely related in various studies with different contexts. A high level of psychological resilience is related to higher levels of hardiness, control, and resistance to stress (Kravchuk, 2021). One study showed a significant positive relationship between hardiness and resilience in mothers with handicapped children (Salehian & Sarvari, 2021). Hardiness has also been established as a moderating variable in resilience (Maddi, 2013; McCubbin, 2001).

Studies have also pointed out significant age differences in hardiness. Magnani (1990) reported hardiness as an antecedent of successful ageing. In a Canadian sample, age was found to be significantly associated with differences in hardiness scores. Hardiness was seen to develop with age and become a stronger trait in older adulthood (Hannah & Morrissey, 1987). Conversely, in a UK sample, a negative correlation was found between hardiness scores and age (Parkes, 1988). The lack of more recent and culturally relevant findings on psychological hardiness in older populations presents a need for more research on this aspect.

There is limited literature on psychological hardiness in the South-Asian context with three studies conducted on an Indian sample. These studies explored gender differences in the scores of hardiness. Sinha (2018) found that males ranked significantly higher than females in all three dimensions of hardiness. In a study investigating the relationship between psychological hardiness and mental health of Indian secondary school boys and girls, the analysis revealed a significant positive correlation between the commitment and challenge components of hardiness and two aspects of mental health: intelligence and self-concept in schoolboys and a negative correlation for girls (Johal, 2020).

2.2 Cognitive Flexibility

In their attempts to operationalize cognitive flexibility, Martin and Rubin (1998) studied the construct in the context of communication, competence, and adaptability. Cognitive flexibility was found to have significant positive correlations to related constructs of communication competence, assertiveness, and responsiveness. Similar to psychological hardiness, cognitive flexibility was found to assist in coping with stress during situational hardships through programming of cognitive processes of perception, memory, and movement (Ionescu, 2012). A high level of cognitive flexibility has been linked to successes in interpersonal relationships, possession of problem-

solving skills, adaptability, and self-efficacy in various contexts (Dennis & Vander Wal, 2010; Moore et al., 2017, as cited in Yağan and Kaya, 2022).

Ageing negatively affects cognitive functions, particularly cognitive flexibility, according to previous studies (Buitenweg et al., 2017; Richard's et al., 2021). However, both younger and older adults can display flexibility in their cognitive processes when equipped with coping mechanisms that allow them to adapt to new situations, despite the fact that younger adults are generally thought to be better at adapting to demanding situations (Cheng et al., 2012; Wilson et al., 2017). In a performance-based study using robotic tasks, it was found that cognitive flexibility exists in adequate amounts in older adults (Romero, 2019). In another study on language use and cognitive flexibility in elders, the use of dynamic language was associated with cognitive flexibility (Wang, 2021). Psychological flexibility, another term for the same construct, was found to be the mediator in the relationship between personality and well-being in young and older adults (Steenhaut, 2020). Kelly et al. (2012) discovered the interaction between flexibility and tenacity and demonstrated how the effect predicted changes in health-related outcomes over a ten-year period in an ageing population.

In Pakistani samples, cognitive flexibility has been positive correlated with entrepreneurial alertness and entrepreneurial intentions, emotion-regulation strategies, and bilingualism (Jiatong et al., 2021; Hussain et al., 2023; Andleeb et al., 2023). While certain research has studied the relationship of cognitive flexibility with mental-health related variables, more research needs to be done to strengthen the associations between cognitive flexibility, other cognitive constructs, personality traits, and coping in older and more culturally relevant populations.

2.3 Cognitive Functioning and Ageing

In clinical populations, cognitive processes have been studied in-depth in neurotypical and neurodivergent adults. In a systematic review of independent studies with major depressive episode group and control groups, cognitive functioning, particularly the functions of selective attention, working memory, and long-term memory, are affected and persist into remission (Semkovska et al., 2019). Conversely, another systematic review on independent studies on adults with ASD and neurotypical adults revealed impairments in cognitive processes of processing speed, working memory, and attention in adults with ASD (Velikonja et al., 2019).

More relevant to the current study, cognitive functioning has been studied in older adults as impacted by the COVID-19 pandemic (De Pue et al., 2021). The study reveals the stressors of the pandemic, low social network, restricted emotional coping led to elevated levels of depression and decreased levels of well-being and cognitive functioning. A special issue investigating the relationship between social isolation and cognitive functioning in later life reported that involvement in social activities, and developing good social networks revealed increased measures of global cognitive function, memory, and executive function (Anstey & Peters, 2019).

Age-related comparisons have been made in the scores of cognitive functioning in adults. Differences in cognitive functioning have been found in the younger age groups of the elderly in an Italian elderly population (Mondini et al., 2021). In a longitudinal study on auditory temporal-order processing and cognitive function, the decline in cognitive function over a 9-year period was seen in middle aged adults and older adults (Humes, 2021).

2.4 Interrelation of the Constructs

A focus on problem solving in the context of coping has been a common covariant in studies on psychological hardiness and cognitive flexibility individually with other variables. In a study by Yağan and Kaya (2022), cognitive flexibility and problem solving were proposed to be protective factors of psychological hardiness. Cognitive flexibility was found to predict psychological

hardiness. The ability to adapt to situations and a focus on increased problem-focused coping aided in the resilience to change features of psychological hardiness. Altinsoy and Aypay (2021) studied problem-focused coping skills as a mediator for psychological hardiness. The perspective adopted by the current study was that hardiness as a trait can be maintained by employing problem focused coping skills rather than emotional coping skills. In the context of post-traumatic growth, the use of happiness-increasing strategies assists in removing a cognitive block and allows the individual to view the painful event through various perspectives to manage and solve the problem. In a sense, resilient individuals use problem-focused coping to better analyse the situation to cope.

Similar constructs to psychological hardiness such as resilience, perseverance, and grit have been studied with cognitive flexibility. Sünbül (2020) reported significant indirect connections between mindfulness and trait resilience, a construct similar of psychological hardiness, through positive affect and cognitive flexibility. The significant hypothesis suggested evidence for trait resilience increases with mindfulness levels because of flexibility in cognitive processes of attention and perception and holding positive emotions. In the post-Covid changes of EFL classes, Erarsalan (2023) found grit and cognitive flexibility to have a positive significant correlation in assisting EFL teachers to adapt to the situation and mediate stress. In another study that investigated psychological hardiness as a predictor of psychological wellbeing, Ebrahimabad and Mamizade (2022) reported a significant positive correlation between psychological hardiness and cognitive flexibility, denoting psychological hardiness as predictor of well-being in soldiers. Emotional regulation associated with cognitive flexibility promotes cognitive functions such as decision making, and problem solving, processes tied to metacognitive awareness processes (Drigas & Karyotaki, 2019). This ties in with the need for one's self-efficacious awareness and belief in their ability to adapt, solve, and cope.

Nasab et al. (2022) explain the intricate relationship between cognitive functioning, psychological hardiness, and cognitive flexibility. In their study, psychological hardiness was found to be a significant mediator between cognitive flexibility, social support, and academic well-being. Improved intellectual well-being was due to enhanced cognitive functions that led to improved management and planning, and thus coping. Similarly, results of another study revealed a statistically significant positive relationship between higher-order thinking and psychological hardiness. Cognitive functions related to higher-order thinking skills predict psychological hardiness significantly amongst young adults (Abdellatif, 2020).

Cognitive stimulation has been linked with cognitive flexibility and enhanced cognitive functioning. Cognitive flexibility, in terms of task-switching, alongside other cognitive functions such as response inhibition, executive control, working memory in ADHD children, was tested with direct current stimulation (tDCS) over the dorsolateral prefrontal cortex and orbitofrontal context, regions involved in executive cognitive functions. The results revealed the efficacy of task-specific stimulation for improved executive functions (Nejati et al., 2017). Task switching performance and age were associated with subjective cognitive functioning where ageing and inability to switch tasks effectively predicted worsened subjective cognitive function. Distress was also studied in relation to cognitive functioning (Geiger et al., 2019). The current study aims to add to such literature by expanding on how the ability to cope with distress and ability to adapt cognitive processes can affect cognitive functioning. A review by Woods et al. (2023) stated that cognitive stimulation (CS) is an intervention for dementia patients that entails pleasurable activities in social situations. CS has been shown to exhibit cognitive and clinically relevant social improvements, as well as benefits in quality of life, mood, and behaviour. Another study found a positive impact of engaging in mentally stimulating activities on the cognitive function of an ageing population (Brooker et al., 2019). In older workers in Croatia, active engagement in tasks, social involvement, and contribution to the community reduced negative mental health symptoms and aided in retaining specific cognitive functions. (Bjelajac et al., 2019).

Limited research exists on connections between cognitive flexibility, psychological hardiness, and cognitive functioning, or between similar contexts. In two performance-task based studies, Kalia et al. (2023) found that decreased levels of cognitive flexibility led to greater effort in problem-solving tasks. Additionally, they reported the indirect but highly significant effect of grit-perseverance, a construct similar to psychological hardiness, on success in solving challenging problems. In another study by Abdellatif and Zaki (2021), problem-solving was found to be a mediator between habits of mind, a collection of cognitive attitudes that make up a person's cognitive framework and are used by that person in a variety of settings to solve problems or remember how to act in particular circumstances, and psychological hardiness.

The current research aims to bridge the gaps in existing literature by investigating direct relationship between the variables. A lack of research utilizing similar statistical techniques urges the need for literature utilizing different statistical analyses. Similarly, a discrepancy exists in previous research on the effect of age on the variables of psychological hardiness and cognitive flexibility and their relationships. The current study would aim to study age-related differences in the scores of psychological hardiness, cognitive flexibility, and cognitive flexibility.

2.5 Rationale of the Study

Existing research has studied the relationship of the variables above with each other in educational, clinical, as well as organizational settings. However, despite the similarity in their nature, the three variables have not been studied together before. Barely any research exists on the direct relationship between psychological hardiness, cognitive flexibility, and cognitive functioning, especially in the Pakistani context. Moreover, a comparative study in the correlates of the variables in young adults and old adults has yet to be conducted. It's important to study how these variables are interlinked in these populations as it would provide an understanding of how cognitive constructs evolve over an individual's lifespan. Additionally, its focus on the Pakistani context provides culturally relevant insights into how these psychological constructs manifest and interact within a specific cultural framework. This research will bridge the gap that exists in research on these variables not just in Pakistan, but globally as well, and lay the groundwork for further research on this topic.

2.6 Research Questions

RQ1 Is there a relationship between psychological hardiness, cognitive flexibility, and cognitive functioning?

RQ2 Is there a difference in psychological hardiness, cognitive flexibility, and cognitive functioning between young adults and older adults?

RQ3 Do psychological hardiness and cognitive flexibility predict cognitive functioning in younger and older adults?

2.7 Hypotheses

H₁ There are significant relationships between psychological hardiness, cognitive flexibility, and cognitive functioning.

H₂ There are significant differences in psychological hardiness, cognitive flexibility, and cognitive functioning between young adults and older adults.

H₃ Psychological hardiness and cognitive flexibility significantly predict cognitive functioning in young adults and older adults.

3. Method

3.1 Design

This research is a quantitative, descriptive study because psychological hardiness, cognitive flexibility, and cognitive functioning have not been studied together before, specifically in the South-Asian context. Baselines measures would provide context and foregrounding for further in-depth research.

3.2 Study Population

The population of this study is from Lahore. The sample comprised of 288 adults: 150 young adults (18 years to 25 years) and 138 older adults (60 years to 90 years), The original sample size was 300 calculated using G*Power analysis ($d = .30$). The research aimed to target educated or working older adults since they are less likely to suffer from cognitive impairments, issues of visual impairment and hearing impairment, and low English literacy skills that may have hinder them from reading and responding to the assessment. Retired older adults were included as well based on the above-mentioned criteria. Twelve older adults were excluded from the study as they did not meet the inclusion criteria. Non-proportional quota sampling was used to sample the population and convenience sampling was used to collect the data.

3.3 Instruments

The booklet consisted of a sociodemographic questionnaire including information on gender, age, education level, employment status, and formal diagnosis of a cognitively impairing disorder. Three other measures were included to assess following outcomes: the Cognitive Flexibility Inventory (CFS) by Dennis and Vander Wal (2010) was used to study cognitive flexibility and its two domains, alternatives and control, the Dispositional Resilience Scale (DRS-15) by Bartone (2007) was used to measure the hardiness levels through the components of challenge, commitment, control, and the Cognitive Functioning Self-Assessment Scale (CFSS) by Annunziata et al. (2012) was used for measuring the subjective cognitive functioning of the sample in the last 12 months.

3.4 Cognitive Flexibility Inventory (CFI)

It is a 20-item developed by Dennis and Vander Wal (2010). CFI is a 7-point Likert-type measuring tool in which 1 stands for "strongly disagree" and 7 stands for "strongly agree". The inventory contains two subscales: Control and Alternatives. The total score ranges from 20 and 140; between 13 to 91 for the Alternatives subscale, and between 7 to 49 for the Control subscale. There are 6 reverse coded items. The scale exhibited a high internal consistency coefficient, ranging from good to excellent: Alternatives subscale ($\alpha = .91$), Control subscale ($\alpha = .86$), and the total score ($\alpha = .90$). Similarly, the CFI showed high test-retest reliability: total score ($r = .81$), Alternatives subscale ($r = .75$), and Control subscale ($r = .77$).

3.5 Dispositional Resilience Scale-15 (DRS-15)

It's a 15-item questionnaire developed by Paul Bartone based on the original DRS-45. The scale allots 5 items per sub-scale and the subscale scoring ranges from 0 to 15. The DRS-15 measures responses on a 4-point scale where 0 stands for "not at all true" and 3 stands for "completely true". There are 6 reverse coded items. The test-retest reliability coefficient for each of the three

components ranged from .75 to .81, and the overall test-retest reliability for hardiness was found to be 0.78. Overall internal consistency ($\alpha = .82$) and criterion-related validity were also high (Bartone, 2007).

3.6 The Cognitive Functioning Self-Assessment Scale (CFSS)

The CFSS is an 18-item questionnaire developed by Annunziata et al. (2012). The CFSS measures cognitive functioning (e.g., attention, memory, and spatial-temporal orientation) in different domains of life through exemplary daily life situations a 5-point Likert scale where 1 stands for “never” and 5 stands for “always”. The frequency of their acts over the past 12 months is to be taken into account by the participants. The internal consistency of the scale was consistently high ranging from 0.77 to 0.88. The test-retest reliability was also reported to be as high as 0.924.

3.7 Procedure

Institutions with the targeted sample were identified. Permissions were acquired from the relevant organization for data collection. A permission letter to conduct research was also drafted by the Department of Psychology at Forman Christian College (A Chartered University). The participants were reached out in person and briefed about the research and its objectives, the privacy and confidentiality of their data, the risks and benefits of the research, and their voluntary consent was taken. Sites of data collection included private and public universities in Lahore, banks, corporate offices, old-age homes, and religious and political gatherings where an abundance of educated older adults were found. The data was collected on a questionnaire booklet which consisted of the information sheet, consent form, demographics questionnaire, DRS-15, CFI, and CFSS. The estimated time for overall data collection was two months from February 2024 to April 2024. The data was entered into a datasheet only accessible to the researchers of the study and the data, physical and virtual copies, will be discarded after the study is completed and approved.

4. Results

The study aimed to investigate the relationship between psychological hardiness, cognitive flexibility, and cognitive functioning in young adults and older adults. Descriptive statistics were analysed to provide an overview of the sample characteristics and metrics on the study variables. Inferential statistics were utilized to investigate the hypotheses of the study.

4.1 Descriptive Statistics

Table 1 Demographic characteristics

Baseline characteristics	Young adults			Older adults			Full sample		
	<i>N</i>	%	<i>M (SD)</i>	<i>N</i>	%	<i>M (SD)</i>	<i>N</i>	%	<i>M (SD)</i>
Age (in years)	-	-	20.50 (1.86)	-	-	65.95 (6.26)	-	-	42.28 (23.19)
Gender									
Female	92	61.3	-	47	34.1	-	139	51.7	-
Male	58	38.7	-	91	65.9	-	149	48.3	-
Education level									
Intermediate/ Secondary education	5	3.3	-	42	30.4	-	47	16.3	-
Undergraduate	145	96.7	-	42	30.4	-	187	64.9	-
Postgraduate	-	-	-	46	33.3	-	46	16.0	-
Doctoral	-	-	-	8	5.8	-	8	2.8	-

Employment status									
Employed	19	12.7	-	31	22.5	-	50	17.4	-
Self-employed	16	10.7	-	29	21.0	-	45	15.6	-
Unemployed	115	76.7	-	24	17.4	-	139	48.3	-
Retired	-	-	-	54	39.1	-	54	18.8	-

Table 1 summarises the participants' demographics, including age, gender, education level, and employment status. The overall female to male ratio of the study was moderately balanced with the most discrepancies visible in the separate age categories. A higher proportion of female young adults and male older adults were sampled compared to their counterparts in the respective categories. Variation in the education level of older adults was higher than the young adults who classified as mainly undergraduate students. Overall, a greater number of young adults appeared to be educated when compared with older adults. However, a greater number of young adults were unemployed with most older adults being retired.

Table 2 Overall descriptive statistics and psychometric qualities of the scales and subscales

Scale	<i>M</i>	<i>SD</i>	Range	Kurtosis	Skewness	Cronbach's α
Dispositional Resilience	26.14	12.20	5 – 45	1.25	-1.08	.701
Total Score						
Control	9.39	2.89	1 – 15	-.17	-.35	.597
Commitment	9.09	3.04	0 – 15	0.15	-.42	.651
Challenge	7.66	3.12	0 – 15	-.41	-.098	.621
Cognitive Flexibility	94.43	16.64	26 – 134	1.95	-.62	.864
Total Score						
Control	28.49	7.93	9 – 34	-.586	-.33	.756
Alternatives	65.93	12.20	13 – 91	2.84	-1.08	.882
Cognitive Functioning	47.66	11.44	18 – 90	.826	.438	.874
Total Scale						

The mean scores of the dispositional resilience scale indicate a medium level of hardiness amongst participants ($M = 26.14$, $SD = 12.20$). The lowest hardiness score achieved was 5 and the highest was 45, on a scale of 0 – 45. The participants have higher commitment ($M = 9.09$, $SD = 3.04$) and control ($M = 9.39$, $SD = 2.89$) levels as opposed to their level of challenge ($M = 7.66$, $SD = 3.12$), exhibiting medium levels of the sub-traits of hardiness. The range reveals a minimum score of 0 on the commitment and challenge subscales indicating an absence of the traits in certain participants as well.

On a scale of 20 to 140 total scores of cognitive flexibility, the mean total score of participants ($M = 94.43$, $SD = 16.64$) reveals a high level of cognitive flexibility. However, as opposed to the control subscale of hardiness, the mean score on the control subscale of cognitive flexibility ($M = 28.46$, $SD = 7.93$) was considerably on the lower side. The participants appeared to score significantly higher on the alternatives subscale ($M = 65.93$, $SD = 12.20$), indicating a higher use of the subskill.

The self-assessed cognitive functioning appears to be on an average level, neither too high nor too low ($M = 47.66$, $SD = 11.44$). The range of total scores indicates the presence of both extremely high cognitive functioning and extremely low cognitive functioning in the participants.

While the skewness values indicate slight skewness, the values are low and can be ignored as Tabachnick & Fidell (2001) explain that skewness does not make a substantial impact on analyses

of relatively larger samples. Similarly, the kurtosis scores appear to be closer to 0 indicating that the results are clustered in the middle as in a normal distribution sample. The positive kurtosis values of the summarised scales indicate a peaked distribution with heavier tails. The distribution appears to be slightly flatter for the control and challenge subscales of dispositional resilience and the alternatives scale of alternatives. With regard to reliability, excellent internal consistency was revealed by means of Cronbach's α for the majority of the scales and subscales. The subscales of dispositional resilience scale revealed average internal consistency.

Table 3 Descriptive statistics for young adults and older adults

Scale	Young adults			Older adults		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Dispositional Resilience Total Score	25.73	6.09	6 – 38	26.57	6.49	5 – 45
Control	9.98	2.55	2 – 15	8.84	3.14	1 – 15
Commitment	8.33	3.02	0 – 15	9.91	2.85	2 – 15
Challenge	7.51	2.89	0 – 15	7.83	3.36	0 – 15
Cognitive Flexibility Total Score	91.66	13.12	59 – 126	97.43	19.37	26 – 108
Control	27.16	6.89	9 – 41	29.94	8.72	9 – 43
Alternatives	64.50	10.70	30 – 89	97.43	19.37	13 – 91
Cognitive Functioning Total Scale	50.17	11.20	26 – 85	44.93	11.09	18 – 90

A comparison of the mean scores of young adults ($M = 25.73$, $SD = 6.09$) and older adults ($M = 26.57$, $SD = 6.49$) on the dispositional resilience scale indicates a minimal difference with older adults exhibiting slightly higher levels of psychological hardiness. The range indicates more widespread results in the older adults as compared to the young adults. Similarly, the mean scores on the subscales for both subgroups reflect the overall scores of the sample. The slight difference in the mean subscale scores reveals young adults to rank highest on the control element as opposed to older adults exhibiting the ability commit the most.

Mean scores of cognitive flexibility for older adults ($M = 97.43$, $SD = 19.37$) appeared to be slightly higher than the young adults ($M = 91.66$, $SD = 13.12$). However, the difference in the score ranges reveal scores on the lower end with both the lowest and highest score being less than the scores of the young adults. Similarly, the mean scores of older adults reveal slightly higher scores in the control subscale ($M = 29.94$, $SD = 8.72$) than young adults ($M = 27.16$, $SD = 6.89$) and significantly higher scores on the alternatives subscale ($M = 97.43$, $SD = 19.37$), ($M = 64.50$, $SD = 10.70$). Interestingly, the range indicates more widespread scores for the older adults with both the lowest and highest score being at the end of each spectrum as opposed to more clustered scores of the young adults.

Lastly, the young adults revealed slightly better self-assessed cognitive functioning ($M = 50.17$, $SD = 11.20$) than older adults ($M = 44.93$, $SD = 11.09$). However, similar to cognitive flexibility, the scores appeared to be more widespread for older adults as indicated by the range than for younger adults.

4.2 Inferential Statistics

The results of the Pearson's correlations for the overall sample showed a significant strong positive correlation of psychological hardiness with cognitive flexibility [$r = .605$, $n = 288$, $p < .05$], significant negative relationships between psychological hardiness and cognitive functioning [$r = -.446$, $n = 288$, $p < .05$], and cognitive flexibility and cognitive functioning [$r = -.532$, $n = 288$, $p < .05$], with a medium correlational effect.

Table 4 *Correlations for Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning*

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	1	2	3
1. Psychological Hardiness	288	26.14	12.20	-		
2. Cognitive Flexibility	288	94.43	16.64	.605**	-	
3. Cognitive Functioning	288	47.66	11.44	-.446**	-.532**	-

* $p < .05$ ** $p < .01$

Table 5 *Correlations for Components of Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Psychological Hardiness (Control)	288	9.39	2.89	-					
2. Psychological Hardiness (Challenge)	288	9.09	3.04	.140*	-				
3. Psychological Hardiness (Commitment)	288	7.66	3.12	.298**	.237**	-			
4. Cognitive Flexibility (Alternatives)	288	65.93	12.20	.415**	.208**	.467**	-		
5. Cognitive Flexibility (Control)	288	28.49	7.93	.345**	.272**	.366*	.336**	-	
6. Cognitive Functioning	288	47.66	11.44	-.271**	-.225**	-.437**	-.415**	-.478**	-

* $p < .05$ ** $p < .01$

In order to investigate the relationship between the components of the variables, Pearson's correlation coefficients were analysed. The results depicted significant correlations with a weak to medium magnitude. The control component of psychological hardiness showed positive correlations with cognitive flexibility: control [$r = .415$, $n = 288$, $p < .05$], alternatives [$r = .345$, $n = 288$, $p < .05$], of medium effect. Similarly, the challenge component of psychological hardiness depicted weak positive correlations with the alternatives [$r = .207$, $n = 288$, $p < .05$] and control [$r = .272$, $n = 288$, $p < .05$] components of cognitive flexibility. The commitment component had the strongest positive correlations with cognitive flexibility as compared to the other components [$r = .467$; $r = .366$, $n = 288$, $p < .05$]. The relationship between the components of psychological hardiness were found to be weak and positive. Similarly, the alternatives component of cognitive flexibility has a medium positive correlation with the control component [$r = .336$, $n = 138$, $p < .05$]. Both components of cognitive flexibility and the commitment component of psychological hardiness depict stronger negative correlations with cognitive functioning than the challenge and control components.

Table 6 Correlations for Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning in Young Adults

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3
1. Psychological Hardiness	150	25.73	6.09	-		
2. Cognitive Flexibility	150	91.66	13.12	.457**	-	
3. Cognitive Functioning	150	50.17	11.20	-.308**	-.349**	-

p* < .05 *p* < .01

The relationship between the variables in the young adults is depicted in Table 1.6. In young adults, psychological hardiness showed a significant positive correlation with cognitive flexibility [$r = .457$; $n = 150$, $p < .05$]. Moreover, there were significant negative relationships between psychological hardiness and cognitive functioning [$r = -.308$, $n = 150$, $p < .05$], and cognitive flexibility and cognitive functioning [$r = -.349$, $n = 150$, $p < .05$]. The magnitude of the correlations ranged from weak to medium.

Table 7 Correlations for Components of Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning in Young Adults

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Psychological Hardiness (Control)	150	9.98	2.55	-					
2. Psychological Hardiness (Challenge)	150	8.33	3.02	.131	-				
3. Psychological Hardiness (Commitment)	150	7.51	2.89	.317**	.365**	-			
4. Cognitive Flexibility (Control)	150	27.16	6.89	.156	.223**	.316**	-		
5. Cognitive Flexibility (Alternatives)	150	64.50	10.70	.320**	.147	.296**	.070	-	
6. Cognitive Functioning	150	50.17	11.20	-.232**	-.089	-.341**	-.423*	-.156	-

p* < .05 *p* < .01

In younger adults, the relationship between the components of the variable were also analysed to provide an in-depth analysis of the correlations. The results depicted multiple significant correlations with a weak to medium magnitude. The control component of psychological hardiness showed significant positive correlations with commitment [$r = .317$, $n = 150$, $p < .05$], a component of psychological hardiness, and a cognitive flexibility component: alternatives [$r = .320$, $n = 150$, $p < .05$]. Similarly, the challenge component of psychological hardiness depicted weak positive correlations with the commitment component of psychological hardiness [$r = .365$, $n = 150$, $p < .05$], and the control component of cognitive flexibility [$r = .223$, $n = 150$, $p < .05$]. The commitment component showed positive correlations with cognitive flexibility components [$r = .316$; $r = .296$; $n = 150$, $p < .05$]. The components of cognitive flexibility were not significantly correlated. The control and commitment components of psychological hardiness were also weakly and negatively correlated with cognitive functioning, whereas there was a stronger negative relationship between the control components of cognitive flexibility with cognitive functioning.

Table 8 Correlations for Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning in Older Adults

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3
1. Psychological Hardiness	138	26.57	6.49	-		
2. Cognitive Flexibility	138	97.43	19.37	.719**	-	
3. Cognitive Functioning	138	44.93	11.09	-.586**	-.654**	-

p* < .05 *p* < .01

The relationship between the variables in the older adults is depicted in Table 1.7. In older adults, psychological hardiness showed a stronger significant positive correlation with cognitive flexibility [$r = .719, n = 138, p < .05$]. that in young adults. Moreover, there were strong significant negative correlations between psychological hardiness and cognitive functioning [$r = -.586, n = 138, p < .05$], and cognitive flexibility and cognitive functioning [$r = -.654, n = 138, p < .05$].

Table 9 *Correlations for Components of Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning in Older Adults*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Psychological Hardiness (Control)	138	8.84	3.14	-					
2. Psychological Hardiness (Challenge)	138	7.83	3.36	.168*	-				
3. Psychological Hardiness (Commitment)	138	9.91	2.85	.413**	.103	-			
4. Cognitive Flexibility (Control)	138	29.94	8.72	.551*	.301**	.363**	-		
5. Cognitive Flexibility (Alternatives)	138	97.43	19.37	.537**	.247**	.608**	.493**	-	
6. Cognitive Functioning	138	44.93	11.09	-.415**	-.343**	-.473**	-.493**	-.618**	-

* $p < .05$ ** $p < .01$

In older adults, the components of the variables depicted stronger correlations that in young adults. The control component of psychological hardiness showed a weak significant positive correlation with challenge [$r = .168, n = 138, p < .05$], second component of psychological hardiness [$r = .413, n = 138, p < .05$], and strong significant positive correlations with cognitive flexibility components; control [$r = .551, n = 138, p < .05$], alternatives [$r = .537, n = 138, p < .05$]. Similarly, the challenge component of psychological hardiness depicted weak positive correlations with components of cognitive flexibility [$r = .301; r = .247, n = 138, p < .05$] The commitment component showed a weak positive correlation with the control component of cognitive flexibility [$r = .363, n = 138, p < .05$] and a strong positive correlation with the alternatives component [$r = .608, n = 138, p < .05$]. The components of cognitive flexibility showed a strong positive significant correlation [$r = .493, n = 138, p < .05$]. The components of psychological hardiness and cognitive flexibility exhibit strong significant negative correlations with cognitive functioning. The alternatives component of cognitive flexibility had the strongest relationship with cognitive functioning [$r = -.618, n = 138, p < .05$].

Table 10 *Results of t-Tests for Psychological Hardiness, Cognitive Flexibility, and Cognitive Functioning in Young Adults and Older Adults*

Variable	Young Adults		Older Adults		<i>t</i> (286)	<i>p</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Psychological Hardiness	25.73	6.09	26.57	6.49	- 1.132	.259	.133
Cognitive Flexibility	50.17	11.20	44.93	11.09	3.983	.000	.470
Cognitive Functioning	91.66	13.12	97.43	19.37	-2.937	.004	.348

Independent samples t-tests were used to compare the differences in the scores of psychological hardiness, cognitive flexibility, and cognitive functioning in young adults and older adults. There were significant differences in the scores of cognitive flexibility [$t(286) = 3.983, p < 0.05$] and cognitive functioning [$t(286) = -2.937, p < 0.05$] in young adults ($M = 50.17, SD = 6.09$; $M = 91.66, SD = 13.12$) and older adults ($M = 44.93, SD = 11.09$; $M = 97.43, SD = 19.37$). The magnitudes of the differences in the means were strong [$d = .470$; $d = .348$].

Table 11 Regression Coefficients of Psychological Hardiness on Cognitive Functioning in Young Adults

Variables	<i>B</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>P</i>	95%CI
Constant	79.663	-	6.095	13.071	.000	[67.619, 91.708]
Cognitive Flexibility	-.225	-.263	.073	-3.079	.002	[-.369, -.081]
Psychological Hardiness	-.345	-.188	.157	-2.194	.030	[-.656, -.034]

Multiple linear regression was used to test if cognitive flexibility and psychological hardiness significantly predicted cognitive functioning in young adults. The fitted regression model was: Cognitive Functioning Score = $83.835 + (-.284) * (\text{cognitive flexibility score}) - (-.359) * (\text{psychological hardiness score})$. The overall regression was statistically significant [$R^2 = .308, F(2, 147) = 12.937, p < .05$], indicating that 30.8% of the variance in the level of cognitive functioning was explained by the level of psychological hardiness and cognitive functioning in young adults. Cognitive flexibility significantly predicted cognitive functioning in young adults [$\beta = -.413, p < .05$] making the largest unique contribution to the variation. Despite a smaller contribution, psychological hardiness was found to be significantly predicting cognitive functioning as well [$\beta = -.197, p < .05$].

Table 12 Regression Coefficients of Cognitive Flexibility on Cognitive Functioning in Older Adults

Variables	<i>B</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>P</i>	95% CI
Constant	82.687	-	3.646	22.040	.000	[65.133, 77.974]
Cognitive Flexibility	-.275	-.481	.052	-5.261	-.000	[-.379, .172]
Psychological Hardiness	-.411	-.241	.156	-2.632	-.009	[-.720, -.102]

In older adults, the fitted regression model was: Cognitive Functioning Score = $82.687 + (-.275) * (\text{cognitive flexibility score}) - (-.411) * (\text{psychological hardiness score})$. The overall regression was statistically significant [$R^2 = .445, F(2, 135) = 56.424, p < .05$], indicating that 44.5% of the variance in the level of cognitive functioning was explained by the level of psychological hardiness and cognitive functioning in older adults. Cognitive flexibility significantly predicted cognitive functioning in older adults [$\beta = -.481, p < .05$]. Similarly, it was found that psychological hardiness also significantly predicted cognitive functioning [$\beta = -.241, p < .05$], albeit a smaller contribution to the variation.

5. Discussion

The main objective of the study was to investigate how psychological hardiness, cognitive flexibility, and cognitive functioning were related in young adults and older adults. While there were significant correlations overall between the three variables, the present research aims to analyse them from the lens of the two age groups. The correlational analyses indicated that the more psychological hardiness an adult possessed, the greater was their cognitive flexibility. Both young adults and older adults, who were dispositioned to exhibiting adaptive emotional, cognitive, and behavioural responses at the time of adversity (Kobasa 1979), held a self-efficacious perspective and will in bringing out the desired change by seeking present alternatives (Martin & Rubin, 1995). Previously, the conceptualisation of cognitive flexibility as an adaptive skill comprising of the abilities to effectively plan, manage, and problem solve had been associated with ease in coping and resilience (Altinsoy & Aypay, 2021; Yağan & Kaya, 2022). Resilience was found to have manifested through problem-focused coping when strategies involved analysing problems with regaining control (Altinsoy & Aypay, 2021; Martin & Rubin, 1998).

Moreover, since a belief in one's self-efficacy to bring about change is a major component of cognitive flexibility (Dennis & Vander Wal, 2010; Martin & Rubin, 1998), traits such as mindfulness aid in the establishment of such awareness and facilitates the regulation and flexibility of the cognitive state (Sünbül, 2020). Metacognitive awareness processes thus dictate one's sense of control and awareness of their ability to adapt and cope (Drigas & Karyotaki, 2019). Previous literature studied these factors within the context of young or middle-aged adults, leaving older adults out of the picture. Interestingly, older adults exhibit a stronger relationship between psychological hardiness and cognitive flexibility than young adults. Plys et al. (2022) reveal that the higher levels of awareness and self-use of emotional regulation techniques in older adults serve as a reason for the disparity, further suggesting that acceptance and mindful awareness both increase with age.

An analysis of the relationship of both psychological hardiness and cognitive flexibility with cognitive functioning revealed puzzling results. Both variables displayed inverse relationships with cognitive functioning. The present study conceptualised psychological hardiness and cognitive flexibility as protective factors of cognitive functioning, serving as mechanisms laying the groundwork for cognitive maintenance. However, the results provide a distinct picture, indicating a decrease in cognitive functioning as psychological hardiness and cognitive flexibility levels increase.

Cognitive flexibility and cognitive functions such as executive control and working memory were associated with better performance on task-switching and mental switching activities – cognitive flexibility often described as the mechanism underlying the activities. Results had indicated significant improvements in clinical samples ranging from dementia patients and ADHD children as well as normal ageing population (Brooker et al., 2019; Nejati et al., 2017; Woods et al., 2023). The present results clash with previous findings on the mediating effect of cognitive flexibility on well-being in young adults and older adults and positive health-outcome turnout in an ageing population (Kelly et al, 2012; Steenhaut, 2020). Cognitive stimulation was further seen to underline processes such as social engagement which led to active maintenance of cognitive functions (Bjelajac et al., 2019). In the context of COVID-19, stressors related to the pandemic, social restrictedness, and a lack of proper emotional coping led to a decline in cognitive functioning of older adults (De Pue et al., 2021). Social engagement through activities in social networks was directly related to higher levels of cognitive functioning, particularly memory and executive functioning (Anstey & Peters, 2019). Social network density and engagement in stimulating activities, especially post-Covid, appears to be an important factor in determining cognitive functioning, acting as a confounding variable in the current research context. Additional research on the role of social engagement in cognitive ageing could factor in missing components of the

present conceptualised model. Alternatively, the demographic could be kept constant as a means to receive impartial and accurate findings.

Psychological flexibility, akin to cognitive flexibility, was seen to correlate with more negative psychological outcomes in older adulthood including poor psychological health, however, it was noted that psychological flexibility positively associated with QoL (Quality of Life) measures based on biopsychosocial health. Yet, further research suggests specific models of QoL, linked to models of ageing yield inconsistent results. Since psychological flexibility was linked with maladaptive regulation processed, the lack of clarity in positive psychological outcomes of psychological flexibility remains unclear (Plys et al. (2022)). Further research on the mechanisms of psychological flexibility in the light of maladaptive processes might explain the negative correlation between cognitive flexibility and cognitive functioning of the present research.

Cognitive functions and higher-order thinking have been studied as mediators or predictors of psychological hardiness (Abdellatif, 2020; Altinsoy & Aypay, 2021; Yağan & Kaya, 2022), however, the cognitive functions studied (planning, management, decision making, and problem-solving) can be conceptualised as aspects of cognitive flexibility as findings are in line with problem-focusing coping. In fact, the resulting coping style is further associated with a third variable such as improved intellectual and psychological well-being (Ebrahimabad & Mamizade, 2022; Nasab et al., 2022). Cognitive functioning, as Annunziata et al. (2012) approach in their research, broadens the spectrum of cognitive functioning to task-based processes of memory, perception, language etc., categorizing individuals within healthy and clinical clusters. It is possible that the relationship between the present operationalisation of the variables might be coincidental, primarily in young adults, denoted by the weaker relationship between the variables. A greater number of insignificant correlations between the subcomponents of variables was seen in young adults, explaining the overall lower strength of the relationships for the age group. The components of cognitive flexibility, alternatives and control, were highly correlated amongst older adults, revealing that an individual's ability to seek alternative explanations and solutions in times of adversity was associated with their ability to perceive the situation within the extent of their control (Dennis & Vander Wal; 2010). A majority of the older adults taking part in the study had been employed at some point in their lives, ran businesses, or were retired officers. Their range of experiences, both occupational and social, might provide a basis for their greater self-efficacy and adaptive skill. Consequently, the commitment and control components of hardiness were also highly correlated with one another amongst older adults, suggesting that their engagement with life, realistic perception, and commitment to matters was associated with their internal locus of control (Kobasa, 1979). Additional qualitative research can explore the life experiences of older adults to add depth, conceptual clarity, and validity to the present results.

In addition, the control component of hardiness was highly correlated with both components of cognitive flexibility revealing that an internal locus of control would improve the tendencies of perceiving and regaining control, as well as, finding appropriate practical alternative perspectives and solutions in a mental block. The commitment component of hardiness was also highly correlated with the alternatives component of cognitive flexibility suggesting that active engagement with matters with genuine curiosity can be related to finding, with ease, alternative solutions. Bartone et al. (2013) explained the importance of commitment in seeking alternative, creative responses to situations, outlining its influence on adaptability during change. Overall, the alternatives component of cognitive flexibility, and control component of psychological hardiness had the strongest relationships with other variables, revealing the significance of developing an internal locus of control and developing adaptive behaviours through seeking alternatives, in dictating. Interestingly, the challenge component of hardiness, the factor explaining willingness to adapt and deal with adversity, was weakly correlated with the alternatives component of cognitive flexibility, and commitment component of hardiness, despite their confluence suggesting that

willingness might be secondary to a high sense of control over the situation, aligned with a confidence to succeed (Bartone et al., 2013).

The second objective of the study was to investigate if there were significant differences between the scores of psychological hardiness, cognitive flexibility, and cognitive functioning in young adults and older adults. The t-tests revealed significant differences in cognitive flexibility and cognitive functioning scores. A significant difference did not exist for psychological hardiness scores between the two groups. Overall, the raw scores of psychological hardiness, cognitive flexibility, and cognitive functioning appear to be pretty similar in both groups contradicting findings present in pre-existing research. Older adults had slightly higher mean scores of psychological hardiness and cognitive flexibility whereas the self-assessment of cognitive functioning was slightly higher in young adults. Limited research exists on the comparison of psychological hardiness scores between young adults and older adults. The available research presents conflicting results. A higher level of psychological hardiness in older adults might be a developmental milestone as the trait increases with age (Hannah & Morrissey, 1987), or it might possess a negative correlation with age (Parkes, 1988). Regardless, the difference is not significant in the present research suggesting that psychological hardiness is experienced equally by both age groups. Gooding (2012) had also found no significant difference in psychological resilience between young and older adults.

The significant difference in the scores of cognitive flexibility, albeit slight, is unique. In previous studies, both young and older adults were found to display flexibility (Cheng et al., 2012; Wilson et al., 2018). However, the greater scores of cognitive flexibility further validates the presence of the trait in older adults in significant amounts (Romero, 2019). Moreover, the presence of working older adults might indicate entrepreneurial mindset and might explain high levels of cognitive flexibility, as found in Pakistani samples previously. Bilingualism was seen to be a correlate of cognitive flexibility and the differences in language proficiency of mother tongue could be a factor in determining the difference in scores (Jiatong et al., 2021; Hussain et al., 2023; Andleeb et al., 2023).

The average level of cognitive functioning in young adults could be explained in the context of post-pandemic abilities. Kelly et al. (2012) explained the impacts of COVID-19 on cognitive functioning and posed social isolation as the cause for decreased cognitive functioning, especially in soon-to-be young adults. Ingram et al. (2021) also examines how social isolation caused by COVID-19 affects cognitive function in the general population, discovers that social isolation levels have an impact on performance and raise the possibility of cognitive decline, in both young adults and older adults. A speculative take on the difference in scores lies in the examination of post-covid syndrome, especially in young adults, presenting cognitive impairment concerns as opposed to older adults, who showed milder impairment (Herrera et al., 2023). Education has been found to be a significant predictor of cognitive functioning in older adults, reflecting lifestyle choices that might impact cognitive health (Weaver, 2021). The varying levels of education, with a majority of the sample completing graduate school, can account for the increased range, and higher cognitive functioning scores of older adults. A detailed screening process while sampling could remove the effect of such extraneous variables from the study. A greater dispersion of scores in older adults further indicates screening errors in filtering out respondents with cognitive impairment which was self-reported. Cognitive decline as a result of ageing or neurodegenerative diseases could still be present in the screened participants, perhaps undiagnosed, and impact the adults' cognitive functioning and hence lead to the range of responses (Gonzales et al, 2022). Similarly, the respondents were not screened for physical disorders and medication usage which might lead to cognition related side effects (Marvanova, 2016; Shinohara, 2016). The level of mental stimulation through occupational engagement might assist working older adults to perform better on the cognitive tests (Grotz, 2018). Moreover, one's socioeconomic status dictates one's lifestyle choices such as social engagement which further leads to variability in cognitive

functioning scores (Wang et al., 2023). Differences in these demographic variables could explain the heterogeneity in the cognitive functioning of older adults. Future research can account for these variables and incorporate them within the context of the research.

The regression analyses showed the significance of psychological hardiness and cognitive flexibility in determining the extent of cognitive functioning amongst the two age groups. The negative β coefficients further validated that higher levels of psychological hardiness and cognitive flexibility predicted lower levels of cognitive functioning. Apart from the potential factors behind this inverse relationship discussed above explain the complex interaction effect of these variables, as well as the potential impact of multiple confounding variables. Notably, a greater proportion of variance was attributed to cognitive functioning in older adults as opposed to younger adults, suggesting the increasing importance of these variables in the ageing process. Similarly, the greater influence of cognitive flexibility calls for improvement in this key area through cognitive interventions in, while psychological hardiness, albeit less significant, serves as an important correlate of cognitive flexibility, but also a predictor of cognitive functioning.

5.1 Implications

Cognitive stimulation has been directly linked with enhancing cognitive flexibility and cognitive functions associated with psychological hardiness. According to Woods et al. (2023), cognitive stimulation can be distinguished from cognitive training or rehabilitation due to its focus on social activities. Cognitive stimulation involves mental exercises revolving around thinking and memory processes involving discussions on “topics of interest from the past and present, puzzles, word games, and creative practical activities,” delivered by trained staff in structured one-on-one sessions (Woods et al., 2023). While this intervention was focused on improving cognitive health of patients with dementia, similar interventions focused on cognitive functions of ageing populations proved successful. Brooker et al. (2019) found the increased use of number-puzzles, an affordable lifestyle activity, to assist in the preservation of cognitive functions of 50- to 93-year-olds and found significant impacts of cognitive functions like memory and attention. Overall health, including cognitive health, correlates with engagement in enjoyable activities indicate the potential efficacy of lifestyle interventions in older adults (Sala et al., 2019). Furthermore, active engagement with tasks, the structured presence of it within employed individuals, has been seen to improve cognitive functions (Bjelajac et al., 2019). For older adults, continued engagement with tasks post-retirement might assist in retaining cognitive functioning.

As for young adults, cognitive stimulation can be achieved through social engagement processes, improving social network density, and introducing stimulating activities in their lives (De Pue et al., 2021; Stebbins, 2022). Activities involving social interaction and analytical skills can be employed within classrooms as the young adults sampled were university students. Social and intellectual engagement have been seen to delay age-related cognitive declines (Stebbins, 2022; Stine-Morrow, 2007). The present-day education system in Pakistan should be reviewed for its curricula and implementation of instructional approaches aimed at engaging cognitive reservoirs of students.

Psychological hardiness, a variable intrinsically tied with cognitive flexibility, improves with cognitive stimulation techniques, as the development of problem-solving coping would be facilitated. However, specific interventions can be developed to target the underlying self-efficacy driving both variables. Mindfulness techniques have been linked to the establishment of self-awareness, and self-control, improving adaptability and coping (Drigas & Karyotaki, 2019). Plys et al. (2022) suggests the use of ACT (Acceptance and Commitment Therapy) interventions to improve self-awareness and emotional regulation techniques. These metacognitive processes might benefit both young adults and older adults by dictating their levels of psychological hardiness and cognitive flexibility.

The complexity of the dynamics of cognitive functioning with cognitive flexibility and psychological hardiness needs to be better researched. While the underlying mechanism of the constructs might be interrelated, the effects of one variable upon the other might be more nuanced and can be attributed to contextual factors and individual differences. Future research can investigate threshold effects of psychological hardiness and cognitive flexibility, the possibility of maladaptive adaptability, and over-efficacious belief that might be negatively impacting one's use of cognitive functioning through faulty perception of one's abilities and cognitive overload.

Baseline descriptive measures of cognitive functioning in young adults and older adults needs to be re-established, post-covid. Factors such as education level, lifestyle changes, and neurological conditions should be studied within the context of cognitive maintenance on Pakistani samples. Studies with correlational and predictive designs might benefit greatly with accurate descriptive measures of the constructs, especially cognitive functioning, with demographic distinctions.

6. Conclusion

The overall objective of the research was to find how psychological hardiness, cognitive flexibility, and cognitive functioning were related to one another, and age. It was revealed that while higher levels of psychological hardiness were associated with higher levels of cognitive flexibility, the relationship of these constructs with cognitive functioning was inverse, i.e., higher levels of psychological hardiness and cognitive flexibility linked to lower levels of cognitive functioning. Challenging the notions presented by previous literature, the research highlights the potential need to study factors such as social engagement and lifestyle choices, post-covid, that might be influencing the complex relationship between the variables. The significant differences in cognitive flexibility and cognitive functioning scores between older adults and young adults indicating that cognitive flexibility might increase with age, potentially due to the active occupational engagement and greater life experience. Similarly, the stronger relationships of psychological hardiness and cognitive flexibility in older adults further suggest the links between life experiences, emotional regulation, and the constructs, proving the need for this disparity to be studied. While the study implies the importance of cognitive stimulation for maintaining cognitive health through lifestyle and educational interventions, the nuanced impacts of individual and contextual factors should be primarily studied. Overall, the research provides insights into the complexity of the dynamics between psychological hardiness, cognitive flexibility, and cognitive functioning, across young and older adults, emphasising on the importance of targeted research and interventions to support cognitive maintenance throughout the lifespan of individuals.

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