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Level of physical activity, hope of life, and intensity of depressive and anxious symptoms in hemodialysis patients

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ABSTRACT

Introduction: Individuals with advanced-stage chronic kidney disease require hemodialysis, in which the resource has harmful physical and mental effects, and it isstill unclear how the level of physical activity is related to cognitive status in this population. **Objective:** To compare the level of physical activity with hope of life and the intensity of depressive and anxious symptoms in hemodialysis patients. **Methods:** A cross-sectional study carried out with 59 hemodialysis patients dichotomized into two groups (sufficiently active and insufficiently active) according to the level of physical activity (International Physical Activity Questionnaire), evaluated in terms of hope of life (Herth Hope Index) and the intensity of depressive symptoms (Beck Depression Inventory) and anxious (Beck Anxiety Inventory). The association between categorical variables was evaluated using Pearson's chi-square test and numerical variables using the Student's T-test and Mann-Whitney U test ($p<0.05$). **Results:** There was a prevalence of subjects categorized as sufficiently active (64%) and with a minimal depression (57%) and anxiety (59%). Insufficiently active individuals had higher scores on the depression ($p=0.001$) and anxiety ($p=0.019$) instrument, and similar scoreson the hope of life instrument ($p=0.067$). There was a greater intensity of depressive and anxious symptoms in those who were insufficiently active ($p<0.001$; $p=0.003$). **Conclusion:** When compared to insufficiently active, sufficiently active hemodialysis patients have similar hope of life and lower intensity of depressive and anxious symptoms.

Keywords: Renal Insufficiency, Chronic; Renal Dialysis; exercise; hope; depression; anxiety.

INTRODUCTION

Chronic kidney disease (CKD) is characterized by the progressive and irreversible loss of kidney function and its incidence is still obscure in Brazil. It is estimated that 10% of the adult Brazilian population has some deficit in kidney function[1]. When excretory function becomes minimal and unable to guarantee a state of physiological homeostasis, it becomes necessary to adhere to a form of renal replacement therapy, such as hemodialysis, peritoneal dialysis, or kidney transplantation[2].

Hemodialysis is the most widely used modality and aims to remove metabolic waste using extracorporeal blood circulation in specific machinery for this purpose[3]. The hemodialysis process is linked to a context of liminality and ambiguity because, for a few hours, the individual loses their autonomy because they are connected to the machinery. However, this relationship of submission provides survival and autonomy in the interdialytic intervals, enabling their social participation in the most diverse areas[4].

Despite its indispensability, the interdependent relationship between the subject and the therapy is associated with a decline in various physical and mental health indicators. In this sense, evidence indicates low levels of physical activity, which is represented by high rates of sedentary lifestyles[5,6]. Similarly, there may be a deterioration in cognitive ability associated with schooling and an inverse relationship between cognitive status and the length of hemodialysis treatment[7,8], as well as a higher risk of developing depressive and anxiety disorders[9,10]. In addition, the feeling of hope considered a protective coping factor, was little or moderately present[11,12].

The repercussions described need to be explored, as they remain insufficient in scientific literature. Most of the existing studies present evidence evaluating these markers in isolation, and it is unclear how the level of physical activity is related to the mental state in this population.

Thus, this study aimed to compare the level of physical activity with hope of life and the

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intensity of depressive and anxious symptoms in hemodialysis patients.

METHODS

A cross-sectional study was conducted with individuals diagnosed with CKD who were undergoing treatment at a hemodialysis service located in a municipality in the Rio Pardo Valley, Rio Grande do Sul, Brazil. The unit provides hemodialysis care, through the Unified Health System and private health plans, to individuals with CKD from 15 municipalities in the Vale do Rio Pardo and Carbonífera regions of the state. Data collection took place in July 2022, and the research was approved by the Research Ethics Committee of the University of Santa Cruz do Sul, whose Report is 5,510,552 and (CAEE 59815822.0.0000.5343).

The study included individuals aged over 18 of both sexes, diagnosed with CKD, and undergoing weekly hemodialysis therapy (3 sessions/week lasting an average of 4 hours). We excluded the visually impaired subjects who had an altered cognitive state detected by the Mini-Mental State Examination (MMSE), who had been undergoing treatment for <6 months, and who had a comorbidity that limited physical activity.

The study population consisted of 147 individuals, 6 of whom expressed a wish not to take part, 12 were excluded due to visual impairment, 38 because they had an altered cognitive state detected by the MMSE, 23 because they had a comorbidity that limited the practice of physical activity and 9 because they reported a treatment time of <6 months. The final sample consisted of 59 participants, dichotomized into two groups according to their level of physical activity. Figure 1 shows the flowchart representing the sample selection stage of the study.

Methodological procedures

Patients were initially approached in the therapy room during the hemodialysis session, where the objectives of the study were explained, and participation was formalized by signing

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the Informed Consent Form. After adherence, cognitive status was assessed using the MMSE[13,14], instrument. It should be noted that the result obtained was used as an exclusion criterion in the study, with only those with preserved cognitive function being eligible for follow-up.

Information was collected for sample characterization using an evaluation form containing personal data (name, age, schooling, and municipality of residence), anthropometric data (body mass and height), and questions related to therapy (length of treatment, number of weekly sessions and access route for therapy), and for classifying the level of schooling, the cut-off points proposed by Bertolucci et al.[14], were adopted, dichotomizing the participants into the categories ≤8 years of study and >8 years of study. Subsequently, the study participants were provided with the following self-reported survey instruments: International Physical Activity Questionnaire (IPAQ), Herth Hope Index (HHI), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI), which were completed and returned within a week.

Anthropometric assessment

Height was self-reported by the participants and body mass was obtained from the institution's electronic medical records, which referred to dry weight (weight after hemodialysis), which is titrated by the medical team based on body composition assessment by electrical bioimpedance using the Body Composition Monitor (BCM®, Fresenius Medical Care, Bad Homburg, GER). The Body Mass Index (BMI) was calculated using the ratio between body mass and height squared, and the cut-off points established by the World Health Organization were adopted for classification: underweight (BMI <18.5 kg/m^2); normal weight (BMI ≥18.5 kg/m^2 and ≤24.9 kg/m^2); overweight (BMI ≥25 kg/m^2 and ≤29.9 kg/m^2); grade I obesity (BMI ≥30 kg/m^2 and ≤34.9 kg/m^2); grade II obesity (BMI ≥35 kg/m^2 ≤39.9 kg/m^2) and grade III obesity (BMI ≥40 kg/m^2)[15]. The following categories were grouped: underweight and normal weight, and the degrees of obesity, which were named only as obesity.

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Physical Activity Level Assessment

The level of physical activity was assessed using the short form of the IPAQ, which includes 8 questions related to the weekly time spent walking, vigorous and moderate physical activity, including activities conducted during leisure time, in the workplace, at home, and school[16]. The classification used the categories and cut-off points established by Pitanga et al.[17]: sedentary (<10 minutes/week of any type of physical activity); low active (≥10 minutes to <150 minutes/week of walking/moderate physical activity and/or 10 minutes to <60 minutes/week of vigorous physical activity and/or 10 minutes to <150 minutes/week of any combination of walking, moderate or vigorous physical activity); physically active (≥150 minutes/week of walking/moderate physical activity and/or ≥60 minutes/week of vigorous physical activity and/or ≥150 minutes/week of any combination of walking, moderate or vigorous physical activity) and finally very active (≥150 minutes/week of vigorous physical activity, or ≥60 minutes/week of vigorous physical activity plus 150 minutes/week of any combination of walking and moderate physical activity). The low active category was grouped with the sedentary category, and the low active category with the physically active category, being named insufficiently active (IA) and sufficiently active (SA), respectively.

Mental state assessment

Hope of life was assessed using the HHI, which consists of 12 statements investigated using four answers: 1 indicates “completely disagree”; 2 “disagree”; 3 “agree” and 4 “completely agree”. Statements 3 and 6 have inverse scores. The total score obtained ranged from 12 to 48 points, where it was considered that the higher the score, the higher the subject's level of hope[18].

BDI was used to assess the intensity of depressive symptoms. It is a self-reported instrument made up of 21 statements that describe the attitudes and symptoms characteristic of

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depression in a somatic, effective, and cognitive way. There are 4 answers for each item, 0 being "minimal intensity", 1 "mild intensity", 2 "moderate intensity" and 3 "severe intensity". The total sum of the points awarded results in a maximum score of 63 points, classifying the result according to the following cut-off points: 0-11 points, minimal depression; 12-19 points, mild depression; 20-35, moderate depression and 36-63 points, severe depression[19]. The moderate depression category was grouped with the severe depression category, named moderate-severe depression.

To assess the intensity of anxious symptoms, the BAI was used, a similar instrument to the previous one, but made up of 21 statements that reflect the characteristic symptoms of anxiety in a somatic, affective, and cognitive way. It has 4 answers for each statement, where 0 indicates "absolutely not"; 1 "slightly, it didn't bother me much"; 2 "moderately, it was very unpleasant, but I could bear it" and 3 "severely, I could hardly bear it". The total sum of the points awarded generates a maximum score of 63 points, classifying the result as 0-10 points, minimal anxiety; 11-19 points, mild anxiety; 20-30 points, moderate anxiety, and 31-63 points, severe anxiety[20]. The moderate anxiety category was grouped with the severe anxiety category, named moderate-severe anxiety.

Statistical analysis

The data was organized and analyzed using IBM SPSS Statistics for Windows software (version 26.0 Armonk, NY). Descriptive analysis was used to characterize the sample in terms of frequency and percentage, measures of central tendency (mean), and dispersion (standard deviation). For the analytical phase, normality was evaluated using the Shapiro-Wilk test, with subsequent comparison of the IA and SA groups in terms of demographic and anthropometric characteristics, using the student's T-test for independent groups or Mann-Whitney U-test (numerical data) and Pearson's chi-square test (categorical data). The comparison between the

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groups in terms of the scores obtained on the HHI, BDI, and BAI instruments was assessed using the student's T-test and the Mann-Whitney U-test. The intensity of depressive and anxious symptoms was compared between the groups using Pearson's chi-square test. A posteriori power analyses were carried out for each of the tests using the G*Power program (version 3.1.9.7). A significance level of $p<0.05$ was adopted.

RESULTS

The study participants (n=59) had a mean age of 54±12 years and a mean treatment time of 2.4±3.0 years. There was a predominance of men (61%), BMI values compatible with normal weight (56%), and schooling time indicative of high schooling (52%). As for the level of physical activity, 64% were classified as SA, and there was a disparity between the groups in terms of body mass ($p=0.007$) and BMI ($p=0.004$). Table 1 shows the demographic and anthropometric data of the sample group.

Table 2 shows the mental state characteristics, in which higher scores were observed in the BDI ($p=0.001$) and BHI ($p=0.019$), and similar in the HHI ($p=0.067$) in the IA group. However, the test power analysis for the differences in HHI between the groups did not reach the minimum of 80% ($1 - \beta = 0.440$). There was a prevalence of subjects categorized with a minimum depression (57%) and anxiety (59%), with a greater intensity of depression ($p<0.001$) and anxious ($p=0.003$) symptoms in the IA group. The comparisons between the groups in terms of the average scores obtained on the HHI, BDI, and BAI instruments can be seen in panels A, B, and C of Figure 2, respectively.

DISCUSSION

This study found that IA hemodialysis patients had higher levels of depressive and anxiety symptoms and similar levels of hope of life compared to SA patients. There was a

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prevalence of subjects categorized as SA, which contradicts what has already been established in literature.

Cross-sectional evidence[5,21] indicates low levels of physical activity in hemodialysis patients using the IPAQ, with no association with clinical or sociodemographic characteristics or biochemical parameters, but rather with a lack of guidance on physical activity practice. The results of this study are in line with the findings, in which the prevalence of a sufficient level of physical activity can be justified by the exclusion of subjects with altered cognitive status detected by the MMSE since patients with preserved cognitive function have better levels of physical activity[22]. In addition, given that CKD patients have a higher risk of developing dementia, as well as cognitive impairment in functions linked to autonomy, memory, and attention when compared to healthy individuals[23], it should be noted that this study excluded 26% of the study population due to the deterioration of this indicator.

When considering depression and anxiety, these parameters are intricately linked to behavioral, affective, physiological, neurological, and cognitive aspects. When the intensity of these symptoms is disproportionate and persistent, there is a substantial increase in the triggering of depressive and anxiety disorders[24,25]. Costa and Coutinho[26] highlighted two aspects that contribute to this disproportionality in patients with CKD undergoing hemodialysis: (I) changes in the lifestyle of patients and their families, which generate emotional, socioeconomic, and occupational limitations, (II) exposure to factors inherent to the disease, such as the time spent in therapy, constant submission to medical consultations and laboratory tests, the need to adopt restrictive eating habits, in addition to the high expectations linked to kidney transplantation.

Some cross-sectional studies have sought to characterize this population in terms of these psychological disorders. Thus, Dias et al.[27] investigated the presence of depressive and

anxious symptoms in 81 hemodialysis patients, in which 23.4% presented compatibility for probable depressive episodes and 20.9% for probable anxious disorder.

Valle et al.[9] found that 71% of their sample had an anxiety disorder, of which 66% had moderate symptoms and 34% severe. Similarly, Santos et al.[10] reported that 34% of the 68 patients assessed had mild depressive symptoms, 24% had moderate symptoms and 10% had severe symptoms. In this study, there was a prevalence of subjects categorized with a minimal depression and anxiety, however, there were significant percentages in the other categories, and these psychiatric manifestations should be paid attention to, as they have a direct impact on adherence to healthy behaviors and hemodialysis therapy.

When the relationship between psychological aspects and level of physical activity is considered, high scores on the BDI and BAI instruments are associated with a decline in physical performance assessed by functional capacity tests, in which those with probable depressive and anxiety disorders are less physically active[28]. In addition, it has been reported that sedentary patients have a 4.99 higher risk of developing depressive symptoms when compared to active hemodialysis patients[29]. In this study, individuals categorized as IA also showed greater intensity of depressive and anxious symptoms.

About hope of life, this protective feeling is associated with a better quality of life and a greater ability to cope with unfavorable situations[18]. Systematic reviews[30,31] have found that when individuals affected by chronic diseases have satisfactory thresholds of hope, there is greater adherence to healthy behaviors, regardless of the clinical condition, which favors recovery and treatment. When considering the association between hope of life and quality of life in hemodialysis patients from different services, higher scores on HHI were associated with better quality of life, indicating a positive relationship between these parameters[12]. It can also be seen that optimizing the level of hope of life in the family context can have an impact on improving the quality of life of these individuals[32]. In this study, there was no difference

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between the SA and IA groups about this variable, although it should be emphasized that maintaining hope of life with a view to patients adopting healthy habits should still be encouraged.

Although the hemodialysis service in which this study was conducted does not use physical exercise as an intervention, systematic reviews[33,34] show that physical activity reduces depressive and anxiety symptoms in hemodialysis patients. In this sense, the inclusion of intradialytic exercise programs (conducted during sessions) has been seen as a safe and efficient intervention for optimizing physical and psychological parameters and quality of life. This type of intervention can improve physical performance, peak oxygen consumption, and serum hemoglobin levels, as well as reduce depressive and anxiety symptoms in these subjects[34]. These effects can be observed in programs conducted for 12-16 weeks, with exercises performed for 30-90 minutes, 3 times a week[35,36].

By legitimizing the benefits and relevance of regular physical exercise for this population, the need for this therapeutic intervention to be implemented in hemodialysis services becomes evident, to mitigate the systemic repercussions of the disease itself, as well as reduce the burden of mental disorders and sedentary behavior highlighted in the results of this study. However, it is worth highlighting the scarcity of theoretical basis for the applicability of these practices in Brazil, where there is currently a brief indication in the Cardiopulmonary and Metabolic Rehabilitation Guideline published by the Brazilian Society of Cardiology, which mentions that the practice of exercise by hemodialysis patients provides gains in cardiovascular function, physical capacity and quality of life while reducing treatment costs[37]. The above reflects the long road ahead, since the lack of standardization by national bodies through the publication of rehabilitation guidelines, protocols, or consensuses for the treatment of chronic nephropathy, interferes with the process of inserting trained professionals for the proper prescription, supervision, and monitoring of physical exercise programs[38,39].

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The study compared the level of physical activity with hope of life and the intensity of depressive and anxious symptoms in hemodialysis patients, with emphasis on the assessment of cognitive status, which gave greater reliability to the self-reported information. However, there were limitations to the study, such as not calculating the sample size a priori and the use of self-reported data, in which participants may underestimate or overestimate the physical activities performed and the symptoms of depression and anxiety presented, as well as height. However, it is important to note that in addition to height showing little variance in the age range of the participants, according to Moreira et al.[40] there is high agreement when comparing measured and self-reported anthropometric measurements in the Brazilian population, which are considered valid alternatives for determining nutritional status. In addition, about the test power of less than 80% for differences in HHI, it is plausible to consider the possibility of type II error. This means stating that there is no difference between the groups when this difference may exist.

Conclusion

This study found that when compared to IA, SA hemodialysis patients had similar levels of hope of life and lower levels of depression and anxiety symptoms. These findings recommend the need to develop national clinical trials to verify the implications of regular physical exercise on aspects of mental health, considering the specificities of the health system operating in Brazil, as well as the health determinants and conditioning factors to which CKD patients undergoing hemodialysis are exposed. Likewise, it is important to stress the need for national bodies to establish protocols, guidelines, or consensus on the subject, to support the development and implementation of public policies that enable the inclusion of physical exercise programs in the country's hemodialysis services.

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Figure 1: Flowchart of the research sample selection stage.

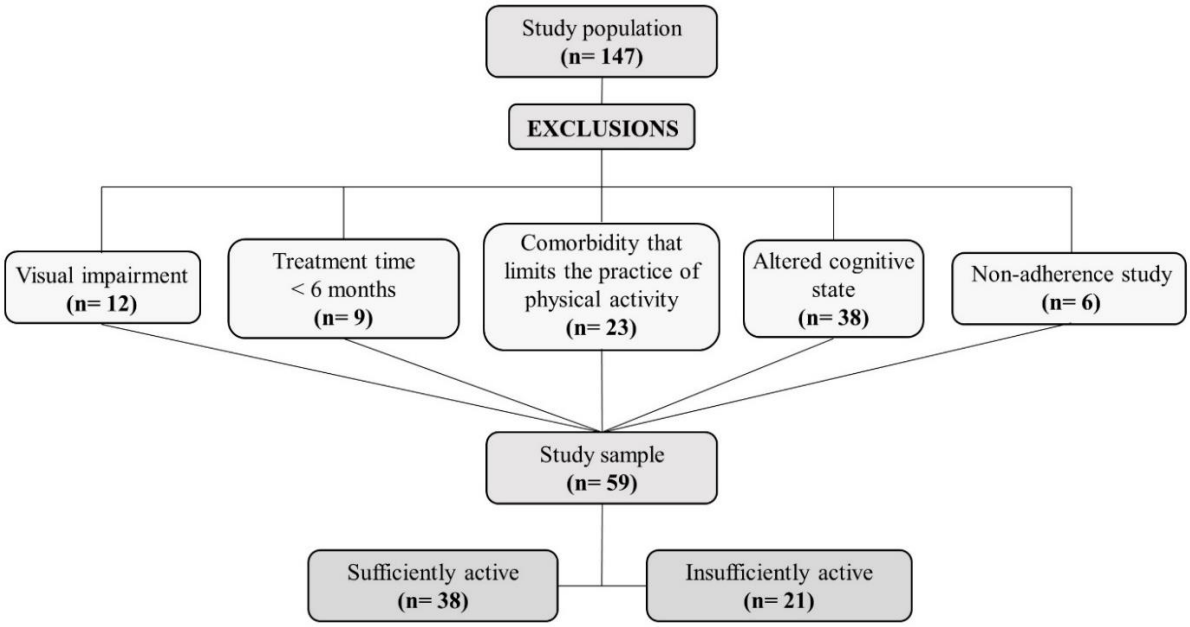

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Table 1: Demographic and anthropometric characteristics of individuals with chronic kidney disease undergoing hemodialysis at a service in the Rio Pardo Valley, 2022.

Variables	SA group (n=38) Mean (SD)	IA group (n=21) Mean (SD)	p	Total (n=59) Mean (SD)
Age (years)	52 (13)	57 (13)	0.156[a]	54 (12)
Body mass (kg)	67 (15)	79 (16)	0.007[a]	71 (16)
Height (m)	1.69 (0.10)	1.70 (0.10)	0.587[a]	1.69 (0.10)
BMI (kg/m^2)	23.50 (5.00)	27.10 (4.70)	0.004[b]	24.80 (5.20)
Treatment time (years)	2.7 (2.9)	1.9 (3.0)	0.081[b]	2.4 (3.0)
		n (%)		
Sex				
Male	21 (55)	15 (71)	0.347[c]	36 (61)
Female	17 (45)	6 (29)		23 (39)
BMI				
Normal weight	24 (63)	9 (43)		33 (56)
Overweight	10 (26)	8 (38)	0.311[c]	18 (30)
Obesity	4 (11)	4 (19)		8 (14)
Schooling				
≤ 8 years of study	16 (42)	12 (57)	0.404[c]	28 (47)
> 8 years of study	22 (58)	9 (43)		31 (53)

Note: Data presented as mean, standard deviation, absolute frequency, and relative frequency; SD: standard deviation; n: number; SA: sufficiently active; IA: insufficiently active; BMI: body mass index; [a]Student's T-test, [b]Mann-Whitney's U and [c]Pearson's chi-square; p<0.05.

Table 2: Characteristics of the mental state of individuals with chronic kidney disease undergoing hemodialysis in service in the Rio Pardo Valley, 2022.

Variables	SA group (n=38) Mean (SD)	IA group (n=21) Mean (SD)	p	Total (n=59) Mean (SD)
HHI score	41 (4)	39 (4)	0.067[a]	40 (4)
BDI score	9 (7)	17 (10)	<0.001[b]	12 (9)
BAI score	9 (8)	14 (9)	0.019[b]	11 (9)
		n (%)		
Intensity of depressive symptoms				
Minimal depression	29 (76)	5 (24)		34 (57)
Mild depression	7 (18)	10 (48)	<0.001[c]	17 (29)
Moderate - severe depression	2 (6)	6 (29)		8 (14)
Intensity of anxiety symptoms				
Minimal anxiety	28 (73)	8 (38)		35 (59)
Mild anxiety	8 (21)	6 (29)	0.003[c]	15 (25)
Moderate-severe anxiety	2 (6)	7 (33)		9 (16)

Note: Data presented as mean, standard deviation, absolute frequency, and relative frequency; SD: standard deviation; n: number; SA: sufficiently active; IA: insufficiently active; HHI: Herth Hope Index; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; [a]Student's T-test, [b]Mann-Whitney U and [c]Pearson's chi-square; p<0.05.

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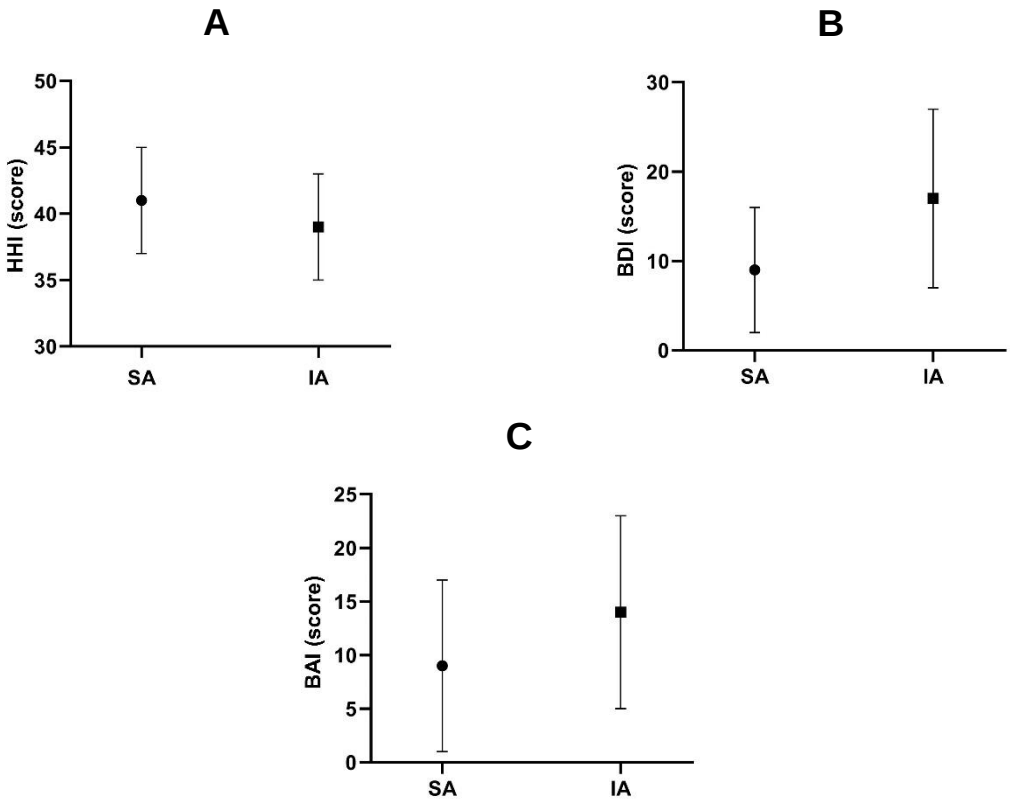
Figure 2: Comparison between the SA and IA groups in terms of the average scores obtained on the HHI (panel A), BDI (panel B), and BHI (panel C) instruments.



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