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Association of AST/ALT (De Ritis) ratio with sarcopenia in a Chinese population of community-dwelling elderly

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ABSTRACT

Background: The aspartate aminotransferase/alanine aminotransferase (AST/ALT) ratio, also known as De Ritis ratio, has been reportedly associated with malnutrition which plays a crucial role in sarcopenia. The aim of this study was to examine the relationship between AST/ALT ratio and sarcopenia in the Chinese community-dwelling elderly.

Methods: A cross-sectional study with 2751 participants (1343 men and 1408 women) aged ≥60 years was performed. Appendicular skeletal muscle mass index (ASMI), grip strength, and gait speed were measured to diagnose sarcopenia according to the latest Asian Working Group for Sarcopenia (AWGS) consensus. The association of AST/ALT ratio with sarcopenia was examined using logistic regression analysis.

Results: The prevalence of sarcopenia in the present study was 4.4%. AST/ALT ratio was higher in the sarcopenia group than in the non-sarcopenia group (1.30 ± 0.33 *vs.* 1.16 ± 0.62, $P = 0.010$). AST/ALT ratio was negatively correlated with the components of sarcopenia, including ASMI, grip strength, and gait speed. Logistic regression analysis indicated that high AST/ALT ratio (>1.20) was associated with increased risk of sarcopenia even after adjustment for potential confounders (adjusted OR = 2.33, 95%CI = 1.48–3.68, $P < 0.001$). Stratification analyses indicated that the association of high AST/ALT ratio with high risk of sarcopenia was more significant in males and the elderly with ≥70 years.

Conclusions: Our findings demonstrate that high AST/ALT ratio is associated with increased risk of sarcopenia in a Chinese population of community-dwelling elderly.

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1. Introduction

Sarcopenia is defined as a progressive loss of skeletal muscle mass plus a decline in muscle strength and/or reduced physical performance with advancing age [1]. Emerging evidence shows that sarcopenia has been associated with increased risk of falls and fracture, poor quality of life, physical disabilities, and mortality [2]. Sarcopenia has therefore gradually become one of the common social health care burdens in the elderly.

To date, the diagnosis of sarcopenia requires measurement of a combination of muscle mass, muscle strength, and physical performance [3]. However, due to the relatively high cost and complexity of the examinations, the convenience and timeliness of the assessment for sarcopenia are limited [4]. Although there have been several studies focused on the finding of sarcopenia-specific non-invasive biomarkers [5]; however, no valid biomarker with high sensitivity and specificity has been identified for the screening of sarcopenia.

Serum liver enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are commonly evaluated in routine clinical practice for liver function test. AST is widely expressed in multiple tissues including liver, myocardium, and muscle, while ALT is mainly located in the liver with small amounts present in the muscle [6]. The AST/ALT ratio, also termed the De Ritis ratio, has been used to differentiate various causes of liver damage, such as alcoholic and nonalcoholic fatty liver diseases (NAFLDs) [7,8], autoimmune liver diseases [9], and hepatitis C [10]. Emerging evidence suggests that the AST/ALT ratio can also serve as a useful biomarker for non-liver diseases such as insulin resistance, chronic kidney disease, cancer, and cardiovascular diseases [11–14]. It has been suggested that in certain situations that some tissues of the body were damaged, AST levels might increase at different levels, resulting in a relatively high level of AST/ALT ratio [15]. Interestingly, a recent study based on middle-aged and older adults from southwest China showed that higher AST/ALT was associated with an increased prevalence of sarcopenia [16]. However, there are still few studies to demonstrate the relationship between the AST/ALT ratio and muscle disorders, especially in the elderly from different areas. Importantly, the variations of dietary habit, lifestyle, sociodemographic factors, and socioeconomic status, *etc.*, may affect not only the level of AST/ALT ratio but also the prevalence of sarcopenia in the elderly from different areas [17,18]. Therefore, the aim of the present study was to investigate the association of AST/ALT ratio with sarcopenia in a population of community-dwelling elderly from east China.

2. Methods

2.1. Study population

This cross-sectional study was based on the National Basic Public Health Project that provides physical examinations for old adults in China annually as previously described [19]. Data were extracted from the subjects who participated in the project at Qixia Medical Center in Nanjing, Jiangsu Province in 2020. Participants with the following conditions were excluded: (1) bedridden or unable to move independently; (2) unable to complete the specified actions for the assessment of grip strength and gait speed; (3) severe heart failure (New York Heart Association heart failure was classified as grade III or IV); (4) severe renal insufficiency (creatinine clearance rate $<$60 ml/min); (5) severe liver damage (levels of transaminase were higher than twice of the normal values); (6) had malignant tumor. Among these participants, 128 were excluded because of missing data and 2751 participants were finally enrolled in the present study. This study was performed in accordance with the principles outlined in the Declaration of Helsinki [20] and approved by the Ethics Committee of Sir Run Run Hospital, Nanjing Medical University (approval number 2019-SR-S041). Written informed consent was obtained from each participant.

2.2. Data collection

Body mass index (BMI) was calculated by dividing weight by height squared. For the measurements of blood and biochemical parameters, venous blood sample was collected in the early morning after an overnight fasting. Hemoglobin, white blood cell, platelet, fasting blood glucose (FBG), ALT, AST, total bilirubin (TB), serum creatinine (SCr), blood urea nitrogen (BUN), triglyceride (TG), total cholesterol (TC), low density lipoprotein-cholesterol (LDL-C), and high density lipoprotein-cholesterol (HDL-C) were measured by an automated chemical analyzer (Olympus Au2700, First Chemical Ltd., Japan).

2.3. Assessment of sarcopenia

According to the latest Asian Working Group for Sarcopenia (AWGS) 2019 criteria, sarcopenia was defined as low muscle mass plus low muscle strength and/or low physical performance [1]. Muscle mass was measured by the method of bioelectrical impedance analysis (BIA) using the device Inbody S10 (Inbody Korea Ltd., Korea). Appendicular skeletal muscle mass (ASM) was calculated as the sum of skeletal muscle in the four limbs by using the formula: ASM = 0.193 × bodyweight + 0.107 × height - 4.157 × gender - 0.037 × age - 2.631 [1]. The height-adjusted ASM index (ASMI) was further calculated by dividing ASM divided by height squared in meters (ASM/height [2]) [1]. A value of ASMI less than 7.0 kg/m^2 in men or less than 5.7 kg/m^2 in women [1] was defined as low muscle mass. Muscle strength was evaluated by measuring the grip strength in the standing position by using a dynamometer (CAMRY EH101, China). The left and right handgrip strength were measured alternately for three times. A maximum value of handgrip strength less than 28 kg in men or less than 18 kg in women, was defined as low handgrip strength [1]. The gait speed was assessed by a 6 m course for three times and the average value was calculated. A value of speed less than 1 m/s was defined as slow gait speed [1].

2.4. Statistical analysis

Kolmogorov-Smirnov test was applied to test the normality of distribution of the variables. Continuous variables were described as mean ± standard deviation. The independent samples *t*-test or Mann-Whitney *U* test was used to determine differences between two groups. Pearson $\chi 2$ test was used to compare the differences of qualitative variables which were represented as frequencies. Receiver operating characteristic (ROC) curve analysis was used to determine the optimum cut-off level of AST/ALT ratio for the prediction of sarcopenia. The correlations between AST/ALT ratio and other variables were calculated using Spearman correlation coefficient. Univariate analysis and multivariate logistic regression analysis were taken to determine the variables that independently contributed to the presence of sarcopenia. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. A two-sided $P < 0.05$ was considered to be statistically significant. All analyses were performed using SPSS 28.0 (SPSS Inc., Chicago, IL).

3. Results

3.1. Characteristics of the study participants

The overall prevalence of sarcopenia in the present study was 4.4% (121/2751). Clinical characteristics of all participants according to sarcopenia status are shown in Table 1. The patients with sarcopenia were older, had higher prevalence of diabetes and lower levels of BMI, grip strength, walking speed, and ASMI. In addition, levels of hemoglobin, platelet, TB, TG, and ALT were lower, while BUN level was higher in the sarcopenia group. Specifically, the AST/ALT ratio was significantly higher in the sarcopenia group than in the non-sarcopenia group. By contrast, no significant difference was observed in the levels of FBG, TC, LDL-C, HDL-C, and AST between sarcopenia and non-sarcopenia groups.

3.2. Correlation of AST/ALT ratio with clinical parameters

We next investigated the relationship of AST/ALT ratio with various clinical parameters. As shown in Table 2, AST/ALT ratio was negatively related to BMI ($r = -0.201$, $P < 0.001$), hemoglobin ($r = -0.275$, $P < 0.001$), BUN ($r = -0.067$, $P = 0.001$), TG ($r = -0.218$, $P < 0.001$), and FBG ($r = -0.281$, $P < 0.001$), but positively correlated with age ($r = 0.164$, $P < 0.001$), TC ($r = 0.070$, $P < 0.001$), and HDL-C ($r = 0.258$, $P < 0.001$) in non-sarcopenia group. Similarly, in patients with sarcopenia, AST/ALT ratio was also negatively correlated with hemoglobin ($r = -0.269$, $P = 0.003$), TG ($r = -0.262$, $P = 0.004$), and FBG ($r = -0.309$, $P = 0.001$), but positively correlated with age ($r = 0.222$, $P = 0.015$). We further analyzed the relationship between AST/ALT ratio and components of sarcopenia. As shown in Fig. 1, AST/ALT ratio was negatively correlated with grip strength ($r = -0.111$, $P < 0.001$, Fig. 1A), walking speed ($r = -0.051$, $P < 0.001$, Fig. 1B), and AMSI ($r = -0.138$, $P < 0.001$, Fig. 1C); however, the significance was lost after adjustment for the above potential confounding factors.

Table 1
Clinical characteristics of participants.

Variables	Sarcopenia (n = 121)	Non-Sarcopenia (n = 2630)	*P* value
Age (years)	75.50 ± 7.86	67.47 ± 5.95	<0.001
Male, n (%)	65 (53.7)	1278 (48.6)	0.270
BMI (kg/m^2)	22.44 ± 2.75	24.73 ± 3.20	<0.001
Grip strength (kg)	19.39 ± 5.18	30.68 ± 9.36	<0.001
Walking speed (m/s)	0.91 ± 0.23	1.13 ± 0.19	<0.001
ASMI (kg/m^2)	5.87 ± 0.75	7.03 ± 0.98	<0.001
Hypertension, n (%)	77 (63.6)	1447 (55.1)	0.062
Diabetes, n (%)	42 (34.7)	690 (26.2)	0.039
Hemoglobin (g/L)	139.06 ± 16.73	144.08 ± 13.58	0.001
White blood cell (× 10^9/L)	6.03 ± 1.59	6.05 ± 1.57	0.871
Platelet (× 10^9/L)	194.48 ± 55.71	209.59 ± 58.46	0.005
FBG (mmol/L)	6.54 ± 2.03	6.52 ± 1.90	0.806
TB (mg/dL)	13.47 ± 7.68	14.29 ± 5.35	0.002
SCr (μmol/L)	92.23 ± 79.14	75.85 ± 23.60	0.090
BUN (mmol/L)	6.71 ± 3.68	5.95 ± 7.07	0.019
TC (mmol/L)	4.91 ± 1.09	4.89 ± 1.01	0.835
TG (mmol/L)	1.36 ± 0.60	1.63 ± 1.32	0.033
LDL-C (mmol/L)	2.90 ± 0.90	2.86 ± 0.82	0.560
HDL-C (mmol/L)	1.47 ± 0.36	1.42 ± 0.36	0.128
ALT (U/L)	18.85 ± 12.55	23.01 ± 15.72	0.004
AST (U/L)	22.30 ± 8.85	23.38 ± 10.77	0.118
AST/ALT ratio	1.30 ± 0.33	1.16 ± 0.62	0.010*

Data are presented as mean ± standard deviation or number with percentage in parenthesis. The independent samples *t*-test or Mann-Whitney *U* test was used to determine differences between two groups. Pearson $\chi 2$ test was used to compare qualitative variables represented as frequencies.
BMI = body mass index; ASMI = appendicular skeletal muscle mass index; FBG = fasting blood glucose; ALT = alanine aminotransferase; AST = aspartate aminotransferase; TB = total bilirubin; SCr = serum creatinine; BUN = blood urea nitrogen; TG = triglyceride; TC = total cholesterol; LDL-C = low density lipoprotein-cholesterol; HDL-C = high density lipoprotein-cholesterol.

Table 2
Spearman's correlation of the AST/ALT ratio with clinical parameters.

	Sarcopenia (n = 121)		Non-sarcopenia (n = 2630)	
Variables	*r*	*P* value	*r*	*P* value
Age	0.222	0.015	0.164	<0.001
BMI	0.002	0.982	−0.201	<0.001
Hemoglobin	−0.269	0.003	−0.275	<0.001
Platelet	0.094	0.305	−0.027	0.172
TB	−0.060	0.511	−0.017	0.395
BUN	0.035	0.700	−0.067	0.001
TG	−0.262	0.004	−0.218	<0.001
TC	−0.118	0.197	0.070	<0.001
LDL-C	−0.145	0.113	−0.024	0.227
HDL-C	0.047	0.607	0.258	<0.001
FBG	−0.309	0.001	−0.281	<0.001

The correlations between AST/ALT ratio and other variables were calculated using Spearman correlation coefficient.
BMI = body mass index; FBG = fasting blood glucose; ALT = alanine aminotransferase; AST = aspartate aminotransferase; TB = total bilirubin; BUN = blood urea nitrogen; TG = triglyceride; TC = total cholesterol; LDL-C = low density lipoprotein-cholesterol; HDL-C = high density lipoprotein-cholesterol.

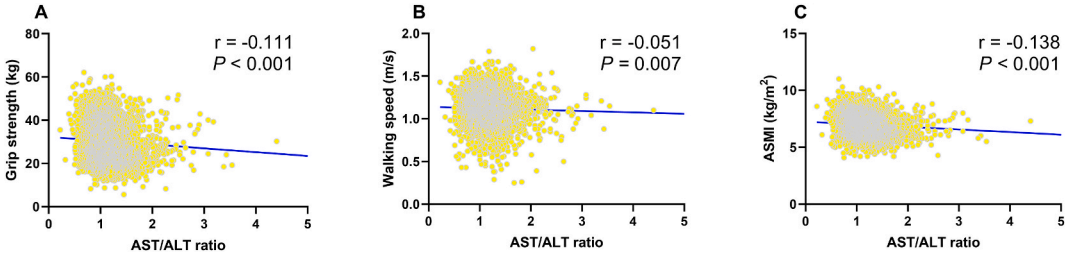

Fig. 1. Association of AST/ALT ratio with the components of sarcopenia. Spearman correlation coefficient was used to analyse the correlation between AST/ALT ratio with grip strength (A), walking speed (B), and ASMI (C). AST, aspartate aminotransferase; ALT, alanine aminotransferase; ASMI, appendicular skeletal muscle mass index.

3.3. Association of AST/ALT ratio with the risk of sarcopenia

As shown in Fig. S1, ROC curve analysis indicated that the optimal cut-off value of AST/ALT ratio that predicted sarcopenia was 1.20 with a sensitivity of 67.8% and a specificity of 63.2% (area under the curve = 0.66, 95% CI = 0.61–0.70, $P < 0.001$). Univariate and multivariate logistic regression analyses showed that higher AST/ALT ratio (>1.20) was significantly associated with increased risk of sarcopenia both before and after adjustment for potential confounders including age, sex, BMI, diabetes, hemoglobin, platelet, TB, TG, and BUN (Table 3). However, the significance of association was lost when using AST/ALT ratio as a continuous variable (Table 3).

3.4. Stratification analyses for the association of AST/ALT ratio with the presence of sarcopenia

Stratified analyses were further conducted according to diabetes, sex and age (Table 4 and Table S1). The AST/ALT ratio was lower in diabetes group (1.08 ± 0.36) when compared to non-diabetes group (1.20 ± 0.67) ($P < 0.001$). We found that higher AST/ALT ratio (>1.20) was significantly associated with increased risk of sarcopenia both in the elderly with (adjusted OR = 3.56, 95%CI = 1.67–7.57, $P < 0.001$) and without (adjusted OR = 1.89, 95%CI = 1.06–3.39, $P < 0.032$) diabetes even after adjustment for the above-mentioned potential confounders. However, the association was lost significance after adjustment for potential confounders when using AST/ALT ratio as a continuous variable (Table S1). In addition, there was also a difference of AST/ALT ratio between men (1.11

Table 3
Associations of the AST/ALT ratio with the presence of sarcopenia.

	Categorical		Continuous	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Crude model	3.48 (2.36–5.13)	<0.001	1.17 (0.99–1.37)	0.061
Adjusted model	2.33 (1.48–3.68)	<0.001	1.08 (0.83–1.40)	0.572

Multivariate logistic regression analysis were taken by adjustment for age, sex, BMI, diabetes, hemoglobin, platelet, TB, BUN, and TG.
ALT = alanine aminotransferase; AST = aspartate aminotransferase; OR = odds ratio; CI = confidence interval.

Table 4
Stratification analyses for the association of the AST/ALT ratio with the presence of sarcopenia.

	Categorical			
	Crude OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value
Diabetes				
Yes	3.85 (2.02–7.32)	<0.001	3.56 (1.67–7.57)	0.001
No	3.58 (2.18–5.86)	<0.001	1.89 (1.06–3.39)	0.032
Sex				
Male	5.61 (3.22–9.78)	<0.001	4.42 (2.27–8.63)	<0.001
Female	2.19 (1.26–3.79)	0.005	1.26 (0.66–2.43)	0.487
Age				
≥70 years	3.60 (2.18–5.94)	<0.001	3.75 (2.13–6.62)	<0.001
< 70 years	1.73 (0.86–3.48)	0.126	1.39 (0.63–3.07)	0.409

Multivariate logistic regression analysis were taken by adjustment for confounding factor as described below.
[a] The adjusted model included age, sex, BMI, hemoglobin, platelet, TB, BUN, and TG.
[b] The adjusted model included age, BMI, diabetes, hemoglobin, platelet, TB, BUN, and TG.
[c] The adjusted model included sex, BMI, diabetes, hemoglobin, platelet, TB, BUN, and TG.
ALT = alanine aminotransferase; AST = aspartate aminotransferase; OR = odds ratio; CI = confidence interval.

± 0.39) and women in our study (1.22 ± 0.76, $P < 0.001$). High AST/ALT ratio was associated with higher risk of sarcopenia after adjustment for potential confounders only in men (adjusted OR = 4.42, 95%CI = 2.27–8.63, $P < 0.001$) but not in women. Finally, the AST/ALT ratio was higher in participants with ≥70 years when compared to those with <70 years (1.26 ± 0.86 *vs.* 1.12 ± 0.41, $P < 0.001$). Similarly, the association of higher AST/ALT ratio with higher risk of sarcopenia was only observed in the elderly older than 70 years (adjusted OR = 3.75, 95%CI = 2.13–6.62, $P < 0.001$).

4. Discussion

In the present study, we showed that the AST/ALT ratio was higher and negatively correlated with sarcopenic components in patients with sarcopenia. Furthermore, by using 1.20 as cut-off value, higher AST/ALT ratio was associated with increased risk of sarcopenia in the elderly. Our results indicate that AST/ALT ratio might be a potential surrogate non-invasive blood marker for sarcopenia in the elderly.

AST and ALT have long been identified as biomarkers of liver injury; nevertheless, their functions in the carbohydrate and protein metabolism also signify them as potential indicators of muscle function [21]. Of the two, ALT is present mainly in the cytosol of the liver, while AST has cytosolic and mitochondrial forms and is present not only in the liver, but also in tissues including heart, skeletal muscle, lung, *etc.* [22]. When AST is higher than ALT, a muscle source of these two enzymes should be considered [23]. For example, intense exercise can increase the AST to 100–1000 U/L and ALT to 50–200 U/L, resulting a high AST/ALT ratio (>1.0) [24]. In addition, high AST/ALT ratio has also been reported in patients with rhabdomyolysis and polymyositis [25–27]. Intriguingly, we found that AST/ALT ratio was negatively correlated with grip strength and walking speed, indicating that high AST/ALT ratio might attribute to muscle dysfunction. Previous studies have demonstrated that AST/ALT can serve as a predictor for various pathological status, including cardiovascular diseases, metabolic syndrome and cancer [28–31]. Consistently, we here showed that the elderly with higher AST/ALT ratio had more risk to develop sarcopenia even after adjustment for potential confounders. Nevertheless, considering the relatively low sensitivity of this cut-off value, further studies are needed to explore the optimal cut-off value of AST/ALT ratio for the diagnosis of sarcopenia.

Interestingly, we found that AST/ALT ratio was lower in patients with diabetes when compared to those non-diabetic subjects. Our results were consistent with previous studies showing that AST/ALT ratio was inversely associated with the risk of insulin resistance and diabetes [30,32,33]. The exact mechanism for the association between AST/ALT ratio and diabetes has not been established; however, there are some possible explanations. For example, it has been reported that high ALT value which results in decreased AST/ALT ratio is related to hepatic insulin resistance and could prospectively predict the development of type 2 diabetes [34]. In addition, decreased AST/ALT can cause the impairment of pancreatic β cells function, leading to the acceleration of the progression from prediabetes to type 2 diabetes [35]. It is noteworthy that the prevalence of patients with diabetes was relatively high (37% in sarcopenia and 26.2% in non-sarcopenia) in our present study, which aroused the possibility that the combination of diabetes might contribute the correlation between AST/ALT ratio and sarcopenia. However, our subgroup analysis showed that high AST/ALT ratio was associated with increased risk of sarcopenia both in the elderly with and without diabetes. Future prospective studies are needed to confirm the predictive effects of AST/ALT ratio on the incidence of sarcopenia in patients with prediabetes or diabetes. Moreover, stratified analyses showed that the correlation between AST/ALT ratio and risk of sarcopenia was only significant in males but not in females. There has been plenty of evidence showing that the prevalence of sarcopenia was higher in the old males than in women [1]. Previous study reported that AST/ALT ratio was higher in the aged women than in their male counterparts, even though both serum AST and ALT concentrations were lower in the females [36]. It remains to be determined whether these sex-related differences in the relationship between AST/ALT ratio and sarcopenia were affected by hormonal influences. Considering AST/ALT ratio is also associated with metabolic syndrome [37], another possible explanation might be attribute to the sex difference in body fat distribution, which is one of the most common characteristics of aging [38].

The high level of AST/ALT ratio in patients with sarcopenia may attribute to the decrease of ALT since no significant change of AST was observed between the two groups. Along with the process of aging, a progressive reduction of ALT levels has been described [39, 40]. Recent studies in different patients also showed that low ALT was associated with sarcopenia and poor outcome in the elderly [41–44]. Consistently, we here also found that serum ALT level was lower in patients with sarcopenia, indicating that low ALT may be a potential biomarker for the poor prognosis of sarcopenia. It is still worth attention that the half-life of ALT (47 h) is longer than AST (17 h), resulting much more rapidly decline of AST level than ALT level [45]. Fanny et al. reported that higher level of AST was associated with sarcopenia in the elderly [46]. We therefore cannot exclude the possibility of misleading picture of unchanged AST levels due to inappropriate time point of examine. Nevertheless, further studies are needed to compare the diagnostic and prognostic effects of ALT alone and AST/ALT ratio on sarcopenia.

The exact mechanism of the link between AST/ALT ratio and sarcopenia remains unclear; however, there are several possible explanations. Skeletal muscle contains isozymes of creatine kinase, lactate dehydrogenase, AST, and ALT, which may release into circulation following muscle damage [47]. An increase of AST/ALT ratio has been documented in inflammatory muscle diseases [25, 26]. Inflammation can induce muscle protein catabolism and promote muscle atrophy, which increases the risk of sarcopenia [48]. Vitamin B6 is an important coenzyme of ALT to promote its synthesis and maintain the function [41]. Among the elderly, especially for those with sarcopenia, declining food appetite intake can cause insufficient vitamin B6 intake, which may in turn lead to decreased ALT level and increased AST/ALT ratio [49,50]. Another potential explanation might be related to atherosclerosis since a link between sarcopenia and peripheral arterial disease (PAD) has been identified [51]. Recent studies showed that high AST/ALT ratio was associated with the presence of PAD in the elderly [52–54]. AST/ALT ratio was positively correlated with brachial ankle brachial pulse wave velocity (baPWV), an indicator of arterial stiffness [52]. Considering the pathophysiology of PAD is characterized by metabolic and structural myopathic changes in skeletal muscles [55], higher AST/ALT ratio (>1.20) in the present population might indicate limb ischemia which is responsible for the decline in strength and function.

Our present study has some strengths. Firstly, although our cross-sectional study was based on a population from east China which was different from the study population of He et al.' s study [16], the consistent results indicate that AST/ALT ratio may serve as a non-invasive biomarker for sarcopenia in the elderly. Secondly, our study was based on a relatively large sample from a population of community-dwelling elderly, therefore avoiding the impact of acute disease status on the muscle function originated from hospitalized population. However, some limitations should also be mentioned. Firstly, the possibility of causality bias was hard to exclude due to the nature of the cross-sectional study. Moreover, a number of hidden confounding factors may also cause bias of analysis, such as dietary habits, exercise, underlying multimorbidity and medication utilization. Secondly, due to the lack of data, the exclusion of participants may present a selection bias in the final results. Thirdly, considering elevated AST/ALT ratio has been linked to many liver and non-liver diseases, there would be various potential confounding factors that may affect the relationship between AST/ALT ratio and sarcopenia. Future studies in patients with specific diseases will help to identify the exact association of high AST/ALT ratio with the risk of sarcopenia. Fourthly, skeletal muscle mass was measured by BIA method, which may be relatively lower accuracy than the method of dual-energy X-ray absorptiometry. However, compared to dual-energy X-ray absorptiometry, BIA is a more accessible and economical measurement for the screening of sarcopenia in the community population. Fifthly, this study was only confined to the elderly in eastern China. Further prospective studies with larger sample sizes and different regions are needed to determine the relationship between AST/ALT ratio and sarcopenia.

5. Conclusions

Our cross-sectional study showed that **AST/ALT ratio was higher in patients with sarcopenia and might be a potential surrogate marker for sarcopenia in the elderly**. Further prospective studies are needed to confirm the results of our study and explore the underlying mechanism for the association of high AST/ALT ratio with increased risk of sarcopenia.

Ethics statement

This study was performed in accordance with the principles outlined in the Declaration of Helsinki and approved by the Ethics Committee of Sir Run Run Hospital, Nanjing Medical University (approval number 2019-SR-S041). Written informed consent was obtained from each participant.

Author contribution statement

Cheng Wu: Performed the experiments; Analyzed and interpreted the data; Wrote the paper. Quan Wang: Performed the experiments; Wrote the paper. Chun-Ya Zhou: Performed the experiments; Analyzed and interpreted the data. Yu-Shuang Lin: Analyzed and interpreted the data. Xin-Feng Jiao; Jin-Shui Xu; Hui-Xian Sun: Performed the experiments.;Xiang Lu; Wei Gao; Zheng-Kai Shen: Conceived and designed the experiments.;Yan Guo: Conceived and designed the experiments; Wrote the paper.

Data availability statement

Data will be made available on request.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e20427.

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