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Original Research

Barriers to Physical Activity in Patients with MASLD: Assessment Using a Validated Version of the Barriers to Being Active Quiz

Alexis Couret*[1,2], Camille Marcantei*[1], James A. King‡[3], Sylvie Massoulier[2], Martine Duclos‡[5,6], Fabrice Rannou‡[5], Bruno Pereira‡[4], Armand Abergel‡[2], Gaël Ennequin‡[1,6]

[1]Clermont Auvergne University, CRNH, AME2P, Clermont-Ferrand, France; [2]Department of Digestive and Hepatobiliary Medicine, CHU Clermont-Ferrand, Clermont-Ferrand, France; [3]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK; [4]Clermont-Ferrand University hospital, Biostatistics unit (DRCI), Clermont-Ferrand, France; [5]Department of Sports Medicine and Functional Explorations, Clermont-Ferrand University Hospital, Clermont-Ferrand, France; [6]International Research Chair "Health in Motion", University Clermont Auvergne Foundation, Clermont-Ferrand, France

*Student Investigator, ‡Established Investigator

Abstract

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Background: Patients with Metabolic dysfunction-Associated Steatotic Liver Disease (MASLD) fail to reach public recommendations for physical activity (PA), and it is necessary today to properly identify the barriers they face to be more active. The present study aimed to evaluate the reliability and reproducibility of a French-adapted version of the Barriers to Being Active Quiz (BBAQ-24 FR) in patients with MASLD. Using this tool, we then examined the perceived barriers to physical activity among French individuals living with MASLD. Methods: Seventy French patients with MASLD (47% women) completed the French version of the BBAQ-24 FR. The reproducibility was tested with the intra-class correlation coefficient (ICC) Results: Seven domains on 8 of BBAQ-24 FR are reproducible (ICC >0.78). Three important barriers were identified: *lack of willpower* with 61% of patients, followed by both *lack of time* and *energy* with 33% of patients. Men have fewer barriers to exercise as do older persons. Conclusion: The BBAQ-24FR appears as a valid tool that can be used in clinical routine to assess which type of barriers hinders PA practice in patients with MASLD.

Keywords: Barriers; Liver; Physical Activity; Exercise; Motivation

Introduction

Steatotic liver disease (SLD) affects more than one-third (~38%) of adults worldwide and is now the leading cause of chronic liver disease, with metabolic dysfunction–associated SLD (MASLD) accounting for the majority of cases.[1] The condition is defined by excessive hepatic fat accumulation (hepatic steatosis) and may progress to liver inflammation, fibrosis, and ultimately advanced cirrhosis, leading to complications such as decompensation, liver failure, and hepatocellular carcinoma.[2] Although it is well accepted that genetic factors[3] and sex-difference[4] play a significant role, it has been shown that physical inactivity and sedentary lifestyles[5] are important risk

Corresponding Author: Gaël Ennequin; Email: gael.ennequin@uca.fr

factors in the development of hepatic steatosis, as well as poor healthy diet.[6] Physical activity (PA) is inversely associated with the prevalence of MASLD, particularly advanced fibrosis;[7] with recent observational data demonstrating a beneficial link between device-measured physical activity and MRI-determined hepatic fibro-inflammation.[8] Despite a clear need for healthy active living behaviours, patients with MASLD often demonstrate insufficient levels of PA along with high levels of sitting.[9] Thus, clinical practice guidelines encourage the evaluation of the patients' lifestyle habits and particularly their physical activity behaviours, as integral components of the overall management of MASLD.[10]

Before implementing any PA intervention, clinicians and practitioners need to identify potential physical, mental and social barriers that are faced by patients to create individualised behaviour change strategies. As largely highlighted in the general population, a lack of motivation is one of the main barriers to PA in patients with MASLD and represents a major limitation to maintaining PA chronically.[11–15] O'Gorman and collaborators observed that a lack of willpower, a lack of time and a lack of energy were the most frequently cited barrier domains in people with MASLD.[16] The authors used the Barriers to Being Active Quiz (BBAQ) which is a questionnaire with 21 questions in 7 domains about barriers to PA. The BBAQ questionnaire is a self-assessment tool to identify barriers to increasing physical activity.[17] The BBAQ questionnaire appears valid and reliable in other populations such as patients with stroke, disability or older adults.[18–21] To our knowledge, the French version of this questionnaire has never been validated in people with MASLD which limits appropriate investigation within French-speaking people.

The present work sought to assess the reliability, and reproducibility of an adapted French version of the BBAQ questionnaire in patients with MASLD. Using this French version of the questionnaire, we then investigated perceived barriers to PA among French patients with MASLD. We hypothesized that the adapted French version of the BBAQ would exhibit satisfactory psychometric properties, including good reliability and reproducibility, in patients with MASLD, and that its use would reveal distinct patterns of perceived barriers to physical activity in this population.

Materials and Methods

Participants

Seventy patients from the Digestive Medicine Department of the Clermont-Ferrand University Hospital participated in this study (70 patients in the first phase, 48 in the second phase and 22 in the third). Inclusion criteria were: adult with exclusively steatotic liver disease of dysmetabolic origin followed in the digestive medicine department, liver fat assessed by MRI (magnetic resonance imagery) and acceptance to participate. Exclusion criteria were the following: MRI contraindication; other etiology of liver disease (*e.g.* chronic alcoholism, hepatitis); hepatic steatosis from secondary etiology (iatrogenic, genetic disease); presence of a liver lesion (hepatocellular carcinoma, malignant or benign lesions). Data were recorded between January and August 2022. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the local ethics committee (N°2022/CE29). This research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science

Protocol

Briefly, the participants were asked to initially complete the French version of the Barriers to

Being Active Quiz (BBAQ-24FR). They were subsequently asked to complete the BBAQ-24FR a second and third time with an interval of at least 7 days. The questionnaires were completed during semi-guided phone interviews led by a member of the investigation group. The BBAQ is a questionnaire with 21 questions organised in 7 domains of 3 questions that assess the barriers to PA in the general population. It was developed by the Centre for Disease Control and Prevention (USA) in 2013[17] and validated in 2014 in older adults.[22] The 7 domains are related to: *Lack of time* (Q1-Q8-Q15) ; *Social influence* (Q2-Q9-Q16) ; *Lack of energy* (Q3-Q10-Q17) ; *Lack of willpower* (Q4-Q11-Q18) ; *Fear of injury* (Q5-Q12-Q19) ; *Lack of skill* (Q6-Q13-Q20) ; *Lack of resources* (Q7-Q14-Q21) (Supplementary file). Responses were recorded on an ordinal scale from 0 = very unlikely to 3 = very likely. A score of 5 or more for an item is considered as an « important barrier » .[17] The average duration to complete the entire questionnaire is approximately 5 minutes.

The BBAQ-24FR (Supplementary file) was derived *via* the following process [23]: i) translation and back translation of the BBAQ by two independent French native speakers fluent in English; ii) back translation review and harmonization between the new translation and the source version; and iii) review of the translation by an expert in exercise physiology and adaptation of the vocabulary where necessary; iii) addition of 3 questions to create a new item about the « influence of pathology » which is scored like other domains (Supplementary File). The score calculation remained the same as the original version of the questionnaire (Supplementary File).

To our knowledge, there is no study assessing the psychometric properties of the English version of the BBAQ. Only a few studies reported psychometrics properties of the questionnaire and only Rublio-Henao and collaborators[18] extensively explored the psychometrics properties of the questionnaire (Internal consistency >0.8 and reproducibility between 0.468 and 0.876).

To assess reproducibility of the BBAQ 24 FR, a test-retest analysis was performed. Three calls are needed for this and T1 corresponds to first call, T2 the second and T3 the third. To reduce recall responses, each call was separated of at least one week and a maximum of two weeks. This interval decreases the risk of change in lifestyle, motivation, psychological status, and PA level.[24] Questionnaires were completed during a call between an investigator and participant. The same investigator oversaw questionnaire completion to reduce bias. Each participant provided written informed consent before taking part.

Statistical Analysis

Sample size was estimated in order to guarantee a satisfactory statistical power to highlight a positive rating for reproducibility. Sample size was determined to provide an acceptable precision for the assessment of test-retest reliability. Assuming an expected ICC (intra-class correlation coefficient) of 0.70 and at least two repeated assessments, approximately 50 participants were considered sufficient to obtain a lower bound of the 95% confidence interval close to 0.50. This sample size is also consistent with the recommendations of Terwee et al., who consider at least 50 participants adequate for reliability assessment and an ICC ≥0.70 indicative of acceptable reliability.[25]

Continuous variables are presented as means with their corresponding standard deviations. In addition to descriptive statistics, the following psychometric properties of the BBAQ-24FR scale were explored using: (i) *Internal consistency* was determined through *Cronbach's alpha coefficient* (minimum accepted value: 0.70) (ii) *Intra-class correlation coefficient* (*ICC*) was calculated using a two-way mixed-effect model with interaction for the absolute agreement, according to

McGraw and Wong recommendations to determine the test-retest reproducibility between T1, T2 and T3.[26] Values ≥ 0.70 were deemed satisfactory. The results were interpreted in relation to the recommendations reported in the literature by Altman[27]: <0.2: no correlation ; 0.2-5 : weak correlation, 0.5-8: moderate correlation, >0.8: strong correlation.

Furthermore, *Student t-test* or *Mann-Whitney test* (if assumptions to apply *t-test* were not met) were used to compare barriers between gender and between younger or older individuals according to the median age (58 years old). Spearman's correlations were performed between age and BBAQ-24FR components. Finally, according to Cohen, if d= 0.8 the effect size is strong, if d = 0.5, the effect size is medium, while for d= 0.2, the effect size is small.

Statistical analyses were performed using Stata software (version 15, StataCorp, College Station, US). All statistical tests were carried out for a two-sided type I error at 5%. Comparisons according to sex and age were considered exploratory secondary analyses. Therefore, no adjustment for multiple testing was applied, and results were interpreted cautiously with particular emphasis on effect sizes and the consistency of observed patterns rather than on p-values alone. For comparisons performed using the Mann–Whitney U test, results are reported as medians with interquartile ranges and Cliff's delta effect sizes.

Results

Patients

Table I summarises the characteristics of the study participants and many had several features of the metabolic syndrome, and few sex-differences are reported.

Psychometric properties of BBAQ 24 FR

Internal Consistency.

Strong *Cronbach alpha coefficients* (>0.8) were found for 2 domains (Lack of time 0.84 and Lack of willpower 0.84) and Total Score (0.86). Moderate coefficients (0.6 to 0.8) were found for 2 domains (Lack of energy 0.75 and Pathology's influence 0.65). Weak coefficients (<0.6) were found for 4 domains (social influence 0.55, fear of injury, lack of skills 0.41 and lack of resources 0.45) (Supplementary file).

Reproducibility.

Seventy French patients with MASLD were contacted for at least one call. Forty-eight patients were contacted for at least two calls with 10.9 days (±3.7) between each call, and 22 patients received three calls with 12.3 days (±5.3) between the second and the third.

Strong intraclass correlation coefficient (*ICC* > 0.8) between T1 and T2, and between T2 and T3 (T1 corresponds to first call, T2 the second and T3 the third) were found for *Lack of time*; *Social influence*; *Lack of energy*; *Lack of willpower*; *Pathology influence*; *Total Score*; Number of important barriers. Moderate concordance's coefficient was found for *Lack of skills* and *Lack of resources* between T1 and T2. *Fear of injury* was the only item which had weak concordance's coefficient between T1 and T2 and between T2 and T3, as detailed in Table II. *Bland & Altman plots* are detailed in Supplementary File.

Questionnaires results

The principal barrier was *Lack of willpower* with a score or 5.04/9±3.0 followed by *Lack of energy* with 3.21/9±3.01 and *Lack of time* with 3.07/9±2.84 (average total scores out of 9 possible points). Sixty-one % participants reported *Lack of willpower* as an important barrier and 33% participants reported *Lack of time* and *Lack of energy*. On the contrary, the *Fear of injury* was not reported as an important barrier. Figure 1 represents the percentage of each barrier as important.

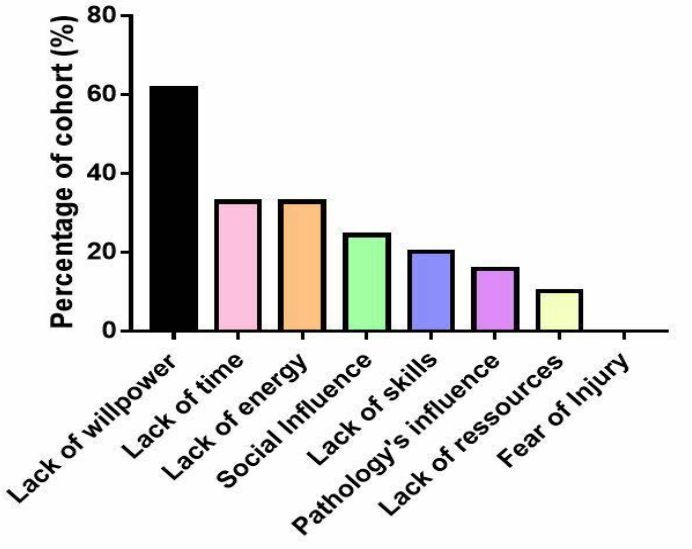

Figure 1. Percentage of important barriers of cohort.

Gender effect.

Women reported more barriers than men for the *Lack of willpower* ($p<0.001$, $d=0.47$); *Social Influence* ($p<0.01$, $d=0.3$); *Pathology's Influence* ($p<0.05$, $d=0.28$); *Total Score* ($p<0.01$, $d=0.32$); and *Number of important barriers* ($p<0.05$, $d=0.36$) (Figure 2). No significant difference was found according to sex for *Lack of time; Lack of energy; Lack of skills; Lack of resources;* and *Fear of Injury* (data not shown).

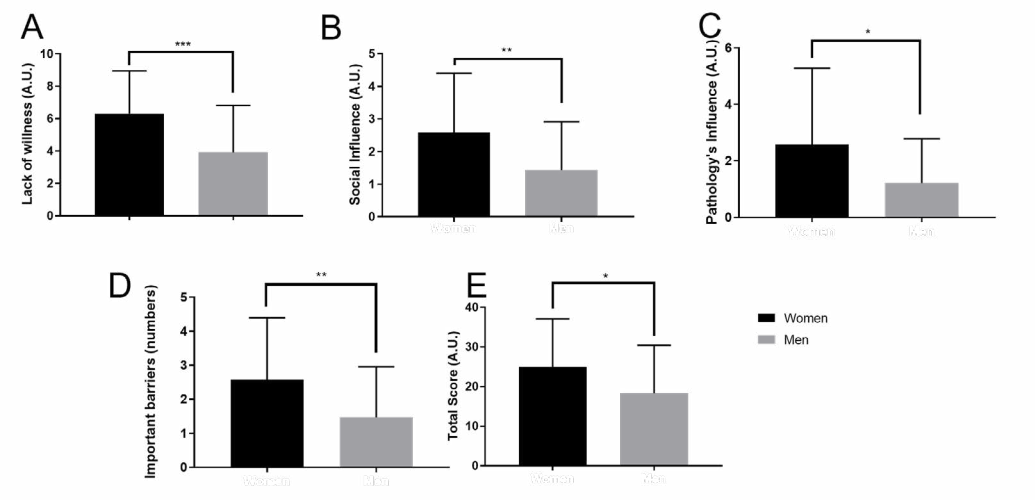

Figure 2. Difference between men and women according to: A) Lack of willpower; B) Social Influence; C) Pathology's Influence; D) Number of important barriers E) Total Score. Mean (±SD), Student T-Test or Mann-Whitney. *=p<0.05 ; **=p<0.01 ; ***=p<0.001

Age effect.

Age was inversely associated with *Lack of energy* (r= -0.56, p<0.001), *Lack of time* (r= 0.57), and *Total Score* (r= -0.38, p=0.001) (Supplementary File). Additionally, we compared the BBAQ scores between older and younger patients according to the median (58 years old).

The *Total Score* for barriers was smaller in the Older group compare with the Young group (p<0.01, d=0.43). Indeed, the Older group had less *Lack of time* (p<0.001, d=0.69), *Lack of energy* (p<0.001, d=0.64), and *Number of important barriers* (p<0.01, d=0.37) (Figure 3). No difference was found according to sex for *Lack of time; Lack of energy; Lack of skills; Lack of resources* and *Fear of Injury* (data not shown).

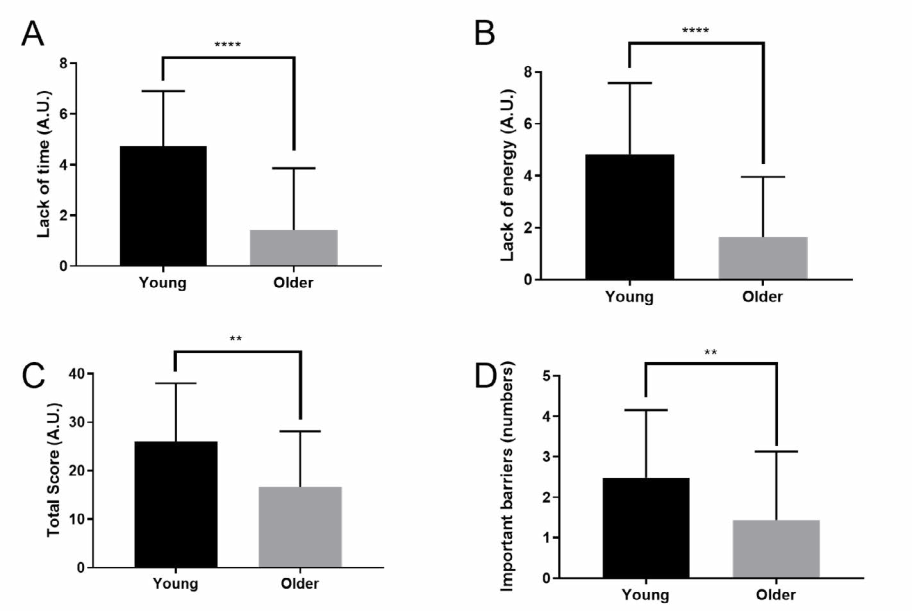

Figure 3. Difference between Young and Older according to: A) Lack of time; B) Lack of energy; C) Total Score; D) Number of important barriers. Mean (±SD), Student T-Test or Mann-Whitney. **=p<0.01 ; ****=p<0.0001

Discussion

PA is a keystone for the prevention and the management of MASLD.[10,28,29] Indeed, PA, even without weight loss, reduces intra-hepatic lipids[30] and is associated with lower hepatic fibro-inflammation.[8] While patients with MASLD have been described with low PA levels,[9] the identification of their barriers to PA is of primary importance to facilitate uptake and adherence to PA interventions. This is particularly important since it has been reported that patients with chronic liver disease have more barriers to PA than the general population and that these barriers are amplified.[31] In that context, the first aim of the present work was to develop a French questionnaire (BBAQ-24FR) to assess these barriers in this clinical population. This questionnaire was adapted from the BBAQ which has been validated in older adults.[22] According to our results, the BBAQ-24FR shows a high degree of reproducibility in patients with MASLD. Also, the BBAQ-24FR has high internal consistency with a weak to strong coefficient for each item. The validity or reproducibility of BBAQ have been scarcely studied in the literature. Nonetheless, these results are in line with Zalewski and Dvorak who also have reported a high internal consistency [κ = 0.87] for the BBAQ questionnaire in patients with stroke.[19] Similarly, Sawchuk and collaborators reported a strong internal consistency for the total score and α coefficients ranging from 0.77 to

0.45 for the domains.[20] Finally, Vasudevan and colleagues reported Cronbach's alpha coefficients ranging from 0.792 to 0.935 for their questionnaire adapted from the BBAQ in individuals with disabilities.[21]We did not evaluate construct validity because it's impossible to have a gold-standard measurement of barriers to exercise. However, a previous study found a negative association between PA level, assessed with an accelerometer, and the total barriers to PA in people suffering from obesity as a surrogate marker of construct validity.[32] However, in our study, patients did a PA level evaluation through a questionnaire and equivalent results were found.

The second objective was to use our new French version BBAQ-24FR to determine barriers to PA in our French cohort of patients with MASLD. The results show that *Lack of willpower* is the most important barrier, followed by *Lack of time* and *Lack of energy*, while *Fear of Injury* did not influence PA practice. Our findings align with those of O'Gorman et al., (2021) and Stine et al., 2021, who also identified lack of willpower, time and energy as the primary barriers to PA in MASLD.[15,33] This consistency between studies suggests that these barriers could be disease-specific. However, the absence of fear of injury in our cohort was also reported in Heredia et al., (2022) in patients with MASLD,[13] and this absence is not different according to age.[34] To improve the adherence to PA interventions, identification of the limits of PA engagement appears necessary.

Psychological support (group therapy, family engaging in PA with patient…) to PA in patients with MASLD is effective to promote health and exercise participation even without weight loss, considering barriers could allow this support to improve.[35] Indeed, the lack of confidence and the fear of falling are associated with the difficulty to perform daily activity and can be considered as barriers to practice[12] as well as fatigue and lack of energy.[14,36] Furthermore, the lack of support from healthcare professionals, as reported by Stine et al., (2021) and Williams et al., (2019),[15,31] likely exacerbates other barriers identified in our study. For instance, the absence of individualized advice may reinforce perceptions of low energy among MASLD patients, who struggle to adapt PA to their chronic fatigue. Sixty-six percent of patients reported a preference for personal training to increase their physical activity.[36] Furthermore, research shows clearly that we overvalue individual decision-making and underestimate the impact of our environment on our behaviour, indeed willpower is not enough to promote exercise.[37] There is a need for multidisciplinary teams including dietitians, psychologists, and adapted physical activity supervisors caring for patients with MASLD.[38]

In order to better characterize the profile of the patients with MASLD, we first separated the sample into two groups based on the median age. The results show that the older group have less barriers than the younger (Fig 3.) These results are in line with a previous study that has observed that younger patients suffering from obesity have greater total PA barriers compared with older ones.[32] It should be noted that older adults visit their physicians at least once per year who might advise about PA practice.[39] Also, it has been found that the confidence to exercise increases with age in MASLD patients.[12] Altogether, these results suggest that older individuals could have fewer barriers of PA.

Our results indicate that women have more barriers than men (Fig 2.). To date, there is no study investigating the gender-difference in barriers to PA in patients with MASLD. Nevertheless, our results are in agreement with the current literature in healthy population and people suffering from obesity concerning main barriers (lack of time and energy) or sex-differences.[40–42] One factor that might explain this difference is the higher prevalence of fatigue among women, particularly

in severe cases.[43] In women, psychological distress is the most associated factor with fatigue while muscle weakness is the most important for men with no influence of age.

Limits.

The first limit of this study is the sample size which does not allow to generalizing these results. In our work, unfortunately, the reproducibility between the two first calls were calculated for 48 and not 50 patients. However, as our results were strong with ICC between T1 and T2 equal to 0.899, the lower bound of 95% *CI* was high at 0.828, largely greater than 0.7 too. According to these results, we can reasonably estimate that this work was not underpowered for the analysis of reproducibility. For *ICC* between T2 and T3, the same comments can be argued with a lower bound of 95% CI equal to 0.85, even if only 22 patients were available for this analysis. Finally, questionnaires have been answered with a call between an investigator and a patient, this can be an important limit because investigators can influence results and patients can misinform about their behaviour to correspond with recommendations. However, we were concerned about participants' ability to understand the questionnaire when administered online or via a mobile phone, particularly among older adults.

The French version of BBAQ is a reproducible questionnaire to assess the barriers of PA practice in individuals suffering from MASLD. Its utilisation can be a good tool for clinicians to identify the obstacles to PA and decrease sedentariness. The most important barrier is the *lack of willpower* followed by *lack of time* and *energy*; and we additionally observed that women have more barriers than men and young people more than older people. Thus, exploring gender-related barriers and population-specific factors in appropriated design would provide valuable additional insights. Further investigations are needed to validate this tool with accelerometry and its sensitivity to detect change in MASLD populations.

Conflicts of Interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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