

Healthy Beat Acupunch exercise program: Validation and feasibility study for older adults with reduced physical capacity or probable sarcopenia

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Title Page

Title: Healthy Beat Acupunch Exercise Program: Validation and Feasibility Study for Older Adults with Reduced Physical Capacity or Probable Sarcopenia

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1 **Healthy Beat Acupunch Exercise Program: Validation and Feasibility Study for Older Adults**
2 **with Reduced Physical Capacity or Probable Sarcopenia**

3
4 **Abstract**

5 **Objectives:** This research aims to validate the Healthy Beat Acupunch (HBA) exercise program,
6 determine the feasibility of the HBA exercise program protocol and gain an understanding of
7 the effects on well-being for older adults with sarcopenia. **Design, Setting & Intervention:**
8 Validation of the HBA exercise program was conducted using two rounds of Delphi
9 communication among eight experts. A one-group, pre-post experimental study was
10 conducted with 17 older adults with probable sarcopenia and/or low gait speed at an
11 Australian retirement village. The HBA exercise program lasted 40 minutes per session, three
12 sessions per week for four weeks. **Outcome Measures:** Muscle mass, muscle strength, gait
13 speed and health-related quality of life were assessed before and after the intervention. The
14 HBA exercise program was evaluated via a questionnaire and individual interviews. **Results:**
15 Experts validated the HBA exercise program and deemed it to be simple, safe, suitable and
16 helpful for practice by older adults with sarcopenia. Participants enjoyed the HBA exercise
17 program, planned to continue and would recommend to friends. Frequency, duration and size
18 of the exercise class were appropriate, and they appreciated the trainer's support and
19 directions when mastering the exercise motions. Improvement in participants' gait speed was
20 found post-exercise intervention ($p < .005$). **Conclusion:** The HBA exercise program is
21 appropriate for practice by older adults, particularly those with reduced physical capacity and
22 probable sarcopenia with possible benefits of improved gait speed. Future studies need to
23 consider and overcome the limitations (i.e. study design, sample size) and challenge
24 (participant recruitment) encountered in this research.

25 **Keywords:** Exercise, Older Adults, Health, Well-Being, Reduced Physical Capacity, Probable

26 Sarcopenia

27 **1.0 Introduction**

28 The ageing population accounts for 23% of the global burden of disease [1]. Exercise not only
29 maintains functional independence and improves health in older adults [2], it is also a
30 therapeutic approach to confront age-related sarcopenia [3]. Sarcopenia, which is
31 characterised by the gradual and generalised deterioration of skeletal muscle mass and
32 strength [4], is common in older adults [5] and leads to negative consequences such as
33 physical disability, low quality of life and death [6]. Yet, exercise programs are commonly
34 designed for adults at prime ages with limited consideration for reduced physical function in
35 older adults [7].

36 According to World Health Organisation [8], stimulations of the acupoint and
37 meridians in traditional Chinese medicine can enhance physical and mental functions such as
38 cardiopulmonary function, neuromuscular performance and skeletal health, affect and
39 sensory awareness. Meridians are channels in our body where “qi” (i.e. blood and life energy)
40 flows, and obstruction of these channels can lead to an excess or lack of energy in a specific
41 area that may cause health problems [9]. There are 14 meridians connected to the body
42 surface (i.e. the skin) and up to approximately 365 acupoints that can be used to stimulate
43 and regulate “qi” in order to promote, maintain or restore health [10].

44 Acupunch is a non-invasive practice where a natural parabola is produced by swinging
45 of the relaxed wrist, elbow and shoulder joints to direct cuffing and tapping of the fist/palm
46 onto the targeted acupoint along the meridians to transport “qi” [9]. This mechanism is akin
47 to pumping of the heart where elasticity of the skin can pulsate meridians and produce heat,
48 which helps to clear meridians channels and circulate “qi” [9, 11]. Designed for Chinese older
49 adults, the newly developed Healthy Beat Acupunch (HBA) exercise program by Tsai et al. [12].
50 includes three phases with a total of 24 motions. Full information on HBA development and

51 detailed descriptions of the 24 motions have been published by Tsai et al. [12]. The HBA
52 program was reported to be simple, safe, helpful, and suitable for older adults in a feasibility
53 study by Tsai et al. [12]. To date, the single Taiwanese study on the HBA program revealed
54 positive effects on the health of community dwelling older adults where improvements were
55 found in functional fitness and cardiopulmonary function [13] as well as self-perceived sleep
56 quality, daytime dysfunction, and physical and mental health [14]. Although preliminary
57 research has identified benefits of acupunch in promoting blood circulation and improving
58 chronic illnesses and health problems caused by prolonged sedentary behaviours often seen
59 in Chinese older adults, there is limited to no evidence-based research to support its effects,
60 especially for older adults with reduced capacity (e.g. physical impairment or sarcopenia) or
61 from a western culture. There is a need for culturally relevant physical activity to increase the
62 acceptance, salience, effectiveness and sustainability of the exercise program [15, 16]. The
63 aim of this Australian study is to (a) validate the HBA program for older adults with sarcopenia;
64 (b) determine the feasibility of the HBA program protocol; and (c) gain an understanding of
65 the effects on well-being for older adults with sarcopenia.

66 **2.0 Methods & Materials**

67 **2.1 Validation of the HBA Exercise Program for Older Adults with Sarcopenia**

68 **2.1.1 Design**

69 Validation of the HBA program for older adults with sarcopenia was undertaken using a Delphi
70 approach. Experts' feedback from each Delphi round was summarised to inform changes and
71 then represented to the experts for their response until group consensus among experts was
72 achieved. Ethics approval for this validation study was received from <blinded for review>
73 Human Research Ethics Committee (Reference #2018/102).

74 **2.1.2 Delphi Expert Selection**

75 Purposive sampling was used to select and recruit a panel of experts who were known to the
76 research team from their networks of health care professionals and organisations/providers.
77 A total of 15 experts was invited to be a Delphi expert panellist from Australia and
78 internationally. Panellists were either a health professional experienced with exercise and/or
79 working with older adults with or without sarcopenia or an older adult with sarcopenia who
80 was able to provide direct insight on the perceived pertinence of the HBA program for their
81 condition. Recruited via email, potential expert panellists were provided with a study
82 information sheet that explained the study's objectives, including risks and benefits, the
83 Delphi process and expectations of their participation. Consenting expert panellists were
84 asked to sign and email their written informed consent form back to the research team.

85 **2.1.3 Data Collection & Analysis**

86 Data collection consisted of two rounds of communication that took place from April to
87 September 2018. In *Round 1*, experts were sent information that included the questionnaire
88 as well as an information booklet and a series of four YouTube video links on the HBA program
89 via email. They were asked to (a) read the information booklet and (b) view all of the videos
90 to gain an understanding of the HBA program before completing the questionnaire. The
91 questionnaire sought experts' views of the simplicity, safety, suitability and helpfulness of
92 each exercise motion on a four-point Likert scale from '1' being difficult, dangerous,
93 inappropriate and not beneficial and should be eliminated to '4' being easy, safe, highly
94 appropriate and beneficial where no change was needed. Optional open text responses for
95 each of the 24 exercise motions and each of the three phases of the exercise program were
96 also available to give experts an opportunity to explain their ratings. Data were analysed using
97 IBM SPSS Statistics for Windows Version 23.0. Content validity index (CVI), which is the

98 proportion of experts who have given a rating of 3 or 4 [17], was computed for each individual
99 item (i.e. simplicity, safety, suitability and helpfulness of each exercise motion). Validity for
100 each of the three phases and the overall exercise program were then established using the
101 average CVI for all items within each phase and the entire exercise program. According to
102 Lynn [18], a respective minimum CVI of 0.78 and 0.90 are needed to establish validity for each
103 exercise motion, each of the three phases and the overall exercise program.

104 Additionally, the questionnaire sought experts' demographic information. Using a
105 five-point Likert scale (i.e. '1' strongly disagree to '5' strongly agree) and optional open text
106 responses, experts were asked to further comment on the theoretical basis, setting, duration,
107 clarity of the information booklet and videos, areas of improvements (if needed) and the
108 overall appropriateness of the current form of the HBA program for older adults with
109 sarcopenia. Means and standard deviations for these data were computed via SPSS.

110 Data collected from *Round 1* were summarised, analysed and used to inform changes
111 on the HBA program for older adults with sarcopenia. In *Round 2*, experts were sent an email
112 that consisted of (a) a series of short videos on how the exercise motions of concern identified
113 in *Round 1* evaluation was revised; (b) a revised information booklet with changes highlighted
114 in red font; and (c) a questionnaire that sought their opinion for each of the revised exercise
115 motions and the overall revised HBA program. The same data analysis approach was applied
116 in *Round 1* and *Round 2*.

117 **2.2 Feasibility Testing of the HBA Exercise Program for Older Adults with Sarcopenia**

118 **2.2.1 Design**

119 Feasibility of the HBA program protocol and its effects on well-being for older adults with
120 sarcopenia were assessed using a one-group pre- and post-test quasi experimental study that
121 was conducted at a retirement village in Brisbane, Australia. Ethics approval for this feasibility

122 study was received from <blinded for review> Human Research Ethics Committee (Reference
123 #2018/992).

124 **2.2.2 Participants & Recruitment**

125 Convenience sampling was used to recruit participants who were aged 65 years and older
126 with sarcopenia according to the guidelines of the European Working Group on Sarcopenia in
127 Older People 2 (EWGSOP2) (i.e. experiencing low muscle strength and low muscle mass) [4].
128 They must also be able to stand and were not wheelchair-bound; as well as able to speak and
129 understand English. Participants with health issues that prevented them from engaging in
130 exercises, cognitive impairment as well as those who are unable to give consent or have a
131 diagnosis of osteopenia were excluded from the study.

132 Permission was obtained from the management of a retirement village in Brisbane.
133 Staff at the retirement village (e.g. an Exercise Physiologist) assisted with the identification of
134 potential participants according to the study inclusion and exclusion criteria. Potential
135 participants were invited to an information session conducted at the retirement village.
136 The lead Chief Investigator (CI) distributed study information sheets and consent forms,
137 presented the aims and the requirements of the study as well as answered questions posed
138 by potential participants. With the assistance of a Research Assistant (RA), potential
139 participants who were interested in taking part in the study were then screened according to
140 the inclusion and exclusion criteria. Those who met the criteria and wished to partake in the
141 study were then asked to return a signed consent form directly to either the CI or RA at the
142 information session or via a dropbox placed on the reception counter at the retirement village.

143 **2.2.3 Exercise Intervention**

144 Participants were required to attend the HBA group exercise program for 40 minutes per
145 session, three sessions per week for four weeks. Two sessions were conducted (i.e. one in the

146 morning and one in the afternoon for participants' selection) on Monday, Wednesday and
 147 Friday in a large room that could comfortably accommodate up to 15 participants.
 148 Participants were checked for any balance problems before the exercise program
 149 commenced. Those who experienced balance problems were provided with a chair to hold
 150 for balance support. Participants were trained in the HBA exercise motions, and practice
 151 occurred under the instruction, demonstration and guidance of the *Professional Exercise*
 152 *Trainer*, who was an experienced and Master degree qualified exercise trainer for older adults.
 153 Two exercise activity personnel or volunteers were also present to supervise each session and
 154 to ensure participants' safety.

155 HBA exercise motions were taught incrementally over the first three sessions in the
 156 first week with consideration for participants' stamina and ability (refer to Table 1). Clear
 157 directions were also provided by the trainer on how to use the chair for balance support if
 158 needed, when performing the HBA exercise motions. Participants were informed that they
 159 could stop and rest when needed at any time during the session. As requested by participants,
 160 at the end of the four-week exercise intervention, a DVD recording of the HBA program was
 161 given to participants so that they could continue to practise the HBA exercise at home.

162 **Table 1.** HBA Exercise Program – Session Schedule

Weeks & Sessions	Motions Taught/Recapped
Week 1, Session 1 (trainer only, no video)	Warm-up motions 1-5 Main motions 1-6 Cool-down motions 1-5
Week 1, Session 2 (trainer only, no video)	Warm-up motions 1-5 Main motions 1-6 plus 7-9 Cool-down motions 1-5
Week 1, Session 3 (trainer only, no video)	Warm-up motions 1-5 Main motions 1-9 plus 10-14 Cool-down motions 1-5
Week 2, Sessions 1-3 (trainer only, no video)	Warm-up motions 1-5 Main motions 1-14 Cool-down motions 1-5

Weeks 3 & 4, Sessions 1-3 (trainer with video)	Warm-up motions 1-5 Main motions 1-14 Cool-down motions 1-5
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163 *Abbreviation: HBA = Healthy Beat Acupunch*

164

165 **2.2.4 Data Collection & Analysis**

166 At baseline, participants were screened for any health issues that prevented them from
167 partaking in the HBA program using the Physical Activity Readiness Questionnaire (PAR-Q)
168 [19]. Participants were also screened for sarcopenia. According to the EWGSOP2 criteria on
169 sarcopenia [4], muscle strength, muscle mass and physical performance (gait speed) were
170 assessed respectively by a Takei TTK5401 digital hand dynamometer, a Tanita BC587
171 bioelectrical impedance analysis (BIA) scale and the gait speed test (i.e. < 0.8m/s) within the
172 Short Physical Performance Battery Assessing Lower Extremity Function [20].

173 Demographic information such as age, gender, medical and health conditions as well
174 as health-related quality of life (HRQoL) using the 12-item Short Form health survey (SF-12)
175 [21] was collected prior to the commencement of the exercise intervention. The SF-12 is
176 psychometrically sound[21] and has been used with older people [22, 23]. It is designed to
177 assess (a) physical health (i.e. perceptions of general physical health, physical function, role
178 limitation from physical problems and body pain); as well as (b) mental health (i.e.
179 perceptions on general mental health, social function, role limitation from emotional
180 problems and vitality. Participants' muscle strength, muscle mass, physical performance and
181 HRQOL were collected again after the exercise intervention. At the end of the four-week
182 exercise intervention, feedback on the HBA program was sought where all participants were
183 asked to complete an evaluation questionnaire.

184 Data were analysed using IBM SPSS Statistics for Windows Version 23.0. Descriptive
 185 data (i.e. frequencies, percentages, means and standard deviations) were computed to report
 186 on the feasibility of the study. Paired sample t-tests, with statistical alpha level set at 0.05,
 187 were conducted to examine the change in muscle strength, muscle mass, physical
 188 performance and HRQOL of participants before and after the exercise intervention.
 189 Specifically, for HRQoL, the raw scores of each item were coded, weighted, and summed into
 190 two scales: physical component summary score (PCS) and mental component summary score
 191 (MCS) with higher scores indicating better quality of life [21, 23].

192 **3.0 Results**

193 **3.1 Validation of the HBA Exercise Program for Older Adults with Sarcopenia**

194 Of the 15 invited experts, seven declined to participate due to competing time commitments
 195 of their busy schedule. A total of 8 experts participated in Round 1 Delphi. They were
 196 geriatricians ($n=2$), gerontological nurses ($n=2$), a wellness and lifestyle manager ($n=1$), an
 197 exercise physiotherapist ($n=1$) and older adults with sarcopenia ($n=2$). They were mostly
 198 female ($n=5$) with the majority having experience working with older adults with or without
 199 sarcopenia (refer to Table 2).

200 **Table 2.** Demographic Characteristics of Experts ($n = 8$)

	(%)
Age	
21-30	25%
45-50	25%
51-60	25%
Over 70	25%
Gender	
Female	62.5
Male	37.5
Highest Education Level	
Secondary School	12.5
Graduate Diploma of Certificate	37.5
Masters	12.5

PhD	37.5
Work Status	
Currently Working	75.0
Retired	25.5
Currently Working or Have Worked With (Yes/No)	
Older adults	75.0
Older adults with sarcopenia	62.5

201

202 Results from the *Round 1* evaluation demonstrated that the expert panel members were
 203 generally supportive of the HBA program. Besides agreeing or strongly agreeing with the
 204 setting ($M=4.63$; $SD=0.52$) and frequency ($M=4.13$; $SD=0.84$) of the HBA program, they also
 205 indicated that the theoretical basis of the HBA program was sound ($M=4.13$; $SD=0.99$) and
 206 that the movements were easy to follow ($M=4.50$; $SD=0.54$) with the information booklet
 207 clearly and succinctly written ($M=4.43$; $SD=0.79$). However, support of the current form of
 208 HBA exercise being appropriate for older adults with sarcopenia was not strong ($M=3.25$;
 209 $SD=0.46$). The areas of concern highlighted from the *Round 1* evaluation were the:

- 210 • overall length of the HBA program and the ability of older adults to complete the
 211 exercise program;
- 212 • appropriateness of the HBA program for older adults with limited mobility (or in a
 213 wheelchair); and
- 214 • suitability of several motions in the HBA program for older adults experiencing
 215 problems with balance.

216 Furthermore, as reflected in Table 3, there were 12 specific motions that did not reach the
 217 minimum I-CVI of 0.78 across the four areas of simplicity, safety, suitability and helpfulness.
 218 These were also reflected in the average I-CVI for each of the three phases and the overall
 219 HBA program (i.e. average I-CVI was below the cut-off of 0.90). These concerns were

220 subsequently addressed in the revised HBA program by providing clearer instructions in the
221 information booklet that indicated that:

- 222 • the exercise trainer will oversee the learning of the HBA exercise program, and the
223 motions will be taught incrementally over the sessions depending on the stamina and
224 ability of the older adults with rest time (break) provided;
- 225 • a chair for balance support will be provided for older adults with balance problems;
226 and
- 227 • the HBA program is targeted at older adults with sarcopenia who are able to stand
228 and are not wheelchair-bound.

229 A series of short videos on how the motions of concern identified in the *Round 1* evaluation,
230 can be completed with the use of a chair (i.e. holding on for balance support) was also
231 prepared.

232 In *Round 2* Delphi, one expert withdrew citing time concerns due to a demanding work
233 schedule. Experts reported that the revisions made to the HBA program information booklet
234 were appropriate ($M=4.71$; $SD=0.49$). They felt that the content of the revised HBA program
235 information booklet was clearly and succinctly written ($M=4.86$; $SD=0.38$). In addition, they
236 indicated that the video demonstration of how the motions of concern identified in the *Round*
237 *1* evaluation, can be completed with the use of a chair for support was clear ($M=4.86$;
238 $SD=0.38$). Importantly, the overall revised form of HBA program, with the inclusion of a chair
239 for support where required, was deemed to be appropriate for older adults with sarcopenia
240 ($M=4.71$; $SD=0.49$). The I-CVI for each exercise motion and the average I-CVI for each of the
241 three phases and revised HBA program met the minimum required cut-off across the four
242 areas of simplicity, safety, suitability and helpfulness, reflecting a consensus among the
243 experts.

244 **Table 3.** Content Validity Index for HBA Exercise Program (Rounds 1 & 2)

	Simplicity (I-CVI)		Safety (I-CVI)		Suitability (I-CVI)		Helpfulness (I-CVI)	
	Round	Round	Round	Round	Round	Round	Round	Round
	1	2	1	2	1	2	1	2
Phase 1								
Motion 1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Motion 2*	0.88	1.00	0.63	1.00	0.63	1.00	0.75	1.00
Motion 3	1.00	1.00	0.88	0.88	1.00	1.00	0.88	0.88
Motion 4	0.75	0.75	0.88	0.88	0.88	0.88	0.88	0.88
Motion 5*	0.38	1.00	0.25	1.00	0.38	1.00	0.50	1.00
Average I-CVI	0.80	0.95[^]	0.73	0.95[^]	0.78	0.98[^]	0.80	0.95[^]
Phase 2								
Motion 1	1.00	1.00	0.88	0.88	0.88	0.88	0.88	0.88
Motion 2	1.00	1.00	0.88	0.88	0.88	0.88	0.88	0.88
Motion 3*	0.38	0.86	0.50	0.86	0.50	0.86	0.63	1.00
Motion 4	0.75	0.75	0.88	0.88	0.88	0.88	0.88	0.88
Motion 5	0.75	0.75	0.75	0.75	0.75	0.75	0.88	0.88
Motion 6	0.88	0.88	0.88	0.88	0.88	0.88	0.75	0.75
Motion 7	0.75	0.75	0.75	0.75	0.75	0.75	0.88	0.88
Motion 8*	0.75	1.00	0.75	1.00	0.63	1.00	0.88	1.00
Motion 9*	0.38	0.86	0.50	1.00	0.38	1.00	0.50	1.00
Motion 10*	0.25	1.00	0.38	1.00	0.38	1.00	0.38	1.00
Motion 11*	0.25	1.00	0.25	1.00	0.38	1.00	0.25	1.00
Motion 12*	0.63	1.00	0.50	1.00	0.50	1.00	0.63	1.00
Motion 13*	0.75	1.00	0.63	1.00	0.63	1.00	0.63	1.00
Motion 14*	0.88	1.00	0.75	1.00	0.63	1.00	0.75	1.00
Average I-CVI	0.67	0.92[^]	0.66	0.92[^]	0.64	0.92[^]	0.70	0.94[^]
Phase 3								
Motion 1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Motion 2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Motion 3	0.88	0.88	1.00	1.00	0.75	0.75	0.75	0.75
Motion 4*	0.88	1.00	0.88	1.00	0.50	0.86	0.38	0.86
Motion 5*	0.38	1.00	0.38	1.00	0.38	0.86	0.38	0.86
Average I-CVI	0.83	0.98[^]	0.85	1.00[^]	0.73	0.89[^]	0.70	0.89[^]
Total Average I-CVI	0.73	0.94[^]	0.71	0.94[^]	0.69	0.93[^]	0.72	0.93[^]

Abbreviation: HBA = Healthy Beat Acupunch; I-CVI = Item Content Validity Index

* Motions identified in Round 1 Delphi to be below the acceptable minimum I-CVI

[^] Achieving the required average I-CVI

245

246 **3.2 Feasibility Testing of the HBA Exercise Program for Older Adults with Sarcopenia**247 **3.2.1 Feasibility**

248 A total of 38 potential participants attended the recruitment information session held two
249 weeks prior to the commencement of the exercise intervention. Of these, 23 (60.5%)
250 expressed interest to partake in the study and were subsequently screened for participation.
251 None of them met the criteria for sarcopenia and for one participant, her doctor did not
252 recommend participation in the study based on her poor physical health. However, seven
253 participants met the criteria for probable sarcopenia (i.e. low muscle strength). Furthermore,
254 these seven participants plus another 11 participants (totalling 18 participants) had low gait
255 speed (i.e. $< 0.8\text{m/s}$; ranging from 0.48 to 0.80). As this was a feasibility study, the research
256 team agreed to include all 18 participants in the study given their diagnosis of probable
257 sarcopenia and/or low gait speed according to EWGSOP2 guidelines [4]. The reasons being
258 that (a) these participants would have reflected severe sarcopenia if they also had low muscle
259 strength and mass; and (b) gait speed has been suggested to be a mediating factor for the
260 effect of sarcopenia in older adults and all-cause mortality [24, 25]. For reasons unknown, one
261 participant later declined to complete baseline assessment leaving a participant enrolment
262 rate of 73.9% (i.e. 17 out of 23 participants).

263 Two participants withdrew from the study at the end of week two as one reported
264 being uncomfortable with feelings of shakiness in their legs and feet when doing the exercises
265 and the other experienced low back pain unrelated to the exercise intervention. This reflected
266 a participant retention rate of 88.2% (i.e. 15 out of 17 participants). Session attendance was
267 recorded for the four-week intervention where participants signed the attendance sheet at
268 the beginning of each session. A follow-up phone call was made to participants who missed
269 two consecutive sessions without any explanation or prior notification to encourage their
270 attendance. Across all 17 participants, an overall average attendance rate of 71.6% was
271 recorded, with higher attendance in the afternoon than morning sessions. The average

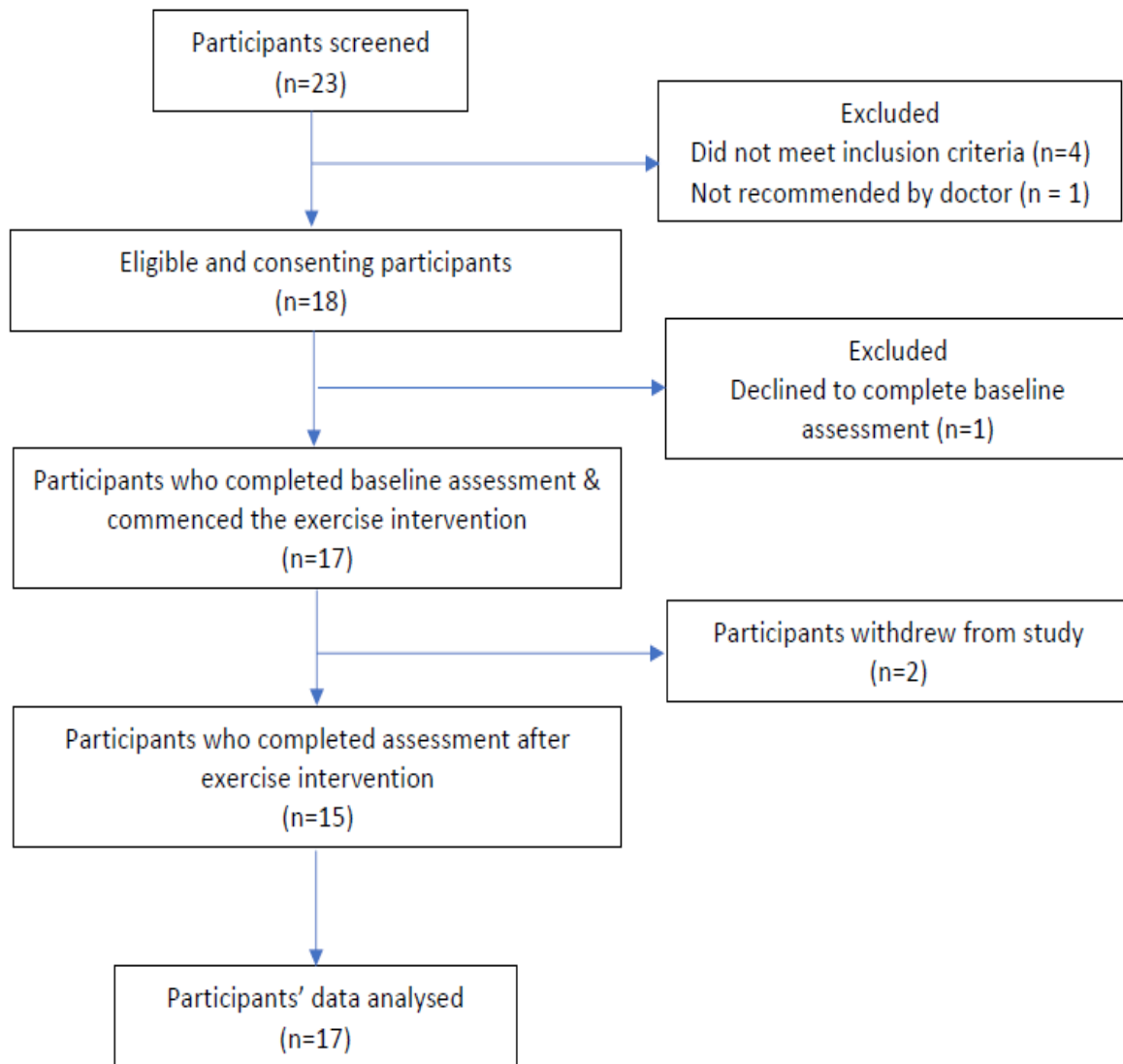
272 attendance rates each week were 74.5%, 64.7%, 72.5%, and 74.5% respectively. Reasons
273 reported by participants for not attending exercise sessions included being away for holidays,
274 doctor appointments, other commitments, family issues, and health issues.

275 No adverse events or effects were reported during the four-week exercise
276 intervention. At the end of week 2, participants' learning was reviewed where all participants
277 could execute the HBA exercise motions with reminders from the trainer. At the start of week
278 3 where the HBA exercise video with music was introduced, the trainer observed and reported
279 that participants initially found it a little difficult to keep up with the speed of the exercise
280 motions set in the video. However, they changed their mind by the end of the week, stating
281 that the pace of the HBA exercise in the video was appropriate. There were no missing data
282 except for the single participant who declined to complete the baseline assessment after
283 returning the signed consent form as well as two participants who withdrew at the end of
284 week two for which the intention to treat using the last known data carried forward approach
285 was used to manage their missing data. A participants' flowchart for the feasibility study is
286 presented in Figure 1.

287 **3.2.2 Participant Characteristics & Study Outcomes**

288 The 17 participating older adults were aged between 71 and 88 years ($M=81.18$; $SD=5.08$).
289 The majority of participants were female ($n = 14$; 82.4%) and right-handed ($n =14$; 82.4%). Of
290 the 17 participants, 15 reported that they were experiencing a range of medical and health
291 conditions including high blood pressure, osteoarthritis, chronic obstructive pulmonary
292 disease, hypertension, diabetes, leaking heart valve, lung infection and minor heart problem,
293 but were still engaging in exercises. Among these 15 participants, one participant had a hip
294 replacement over 10 years ago, and another had received treatment for heart disease.
295 However, they were approved by their doctor to partake in light-moderate intensity exercise,

296 including HBA exercise. Study outcomes of the exercise intervention on upper limb strength,
 297 muscle mass, gait speed and HRQoL are presented in Table 4. A significant difference in gait
 298 speed was found in participants ($p < .005$) with an improved gait speed of 0.90m/s post-
 299 intervention compared to their pre-intervention gait speed of 0.68m/s.



300

301 **Figure 1.** Participant Flowchart

302 **Table 4.** HBA Exercise Program - Pre- and Post-Exercise Intervention Outcome on Upper
 303 Limb Strength, Muscle Mass, Gait Speed & HRQoL ($n = 17$)

	Pre-intervention	Post-intervention	<i>P</i> value
Muscle Strength			
Right upper limb (kg)	19.31 (7.36)	20.07 (7.54)	.09
Left upper limb (kg)	18.11 (8.16)	18.82 (8.15)	.21
Muscle Mass (kg/m ²)	15.90 (2.52)	15.88 (2.36)	.88
Gait speed (m/s)	0.68 (0.13)	0.90 (0.20)	.00
HRQoL			
MCS	56.59 (5.73)	55.47 (6.66)	.42
PCS	41.00 (9.97)	42.59 (7.26)	.40

304 *Abbreviation: HBA = Healthy Beat Acupunch; HRQoL = Health Related Quality of Life; MCS -*
 305 *mental component score on SF-12; PCS - physical component score on SF-12.*

306

307 **Table 5.** HBA Exercise Program Evaluations ($n = 15$)

	Disagree <i>n</i> (%)	Neither Disagree nor Agree <i>n</i> (%)	Agree <i>n</i> (%)	Strongly Agree <i>n</i> (%)
The frequency of the exercise classes (i.e., 3 times per week) was good	-	1 (6.7)	9 (60.0)	5 (33.3)
The duration of each exercise class was good	-	-	10 (66.7)	5(33.3)
The overall length of the exercise program (i.e., 4 weeks) was good	-	2 (11.8)	9 (60.0)	4 (26.7)
The size of the exercise class was appropriate	-	-	8 (53.3)	7 (46.7)
The pace of the exercise was good	-	2 (13.3)	6 (40.0)	7 (46.7)
The trainer was clear in her instruction and clearly demonstrated the exercise motions	-	-	6 (40.0)	9 (60.0)
The instructor supported or helped me in learning the movements	-	-	6 (40.0)	9 (60.0)
The exercise movements were easy to learn	1(6.7)	1(6.7)	7(46.7)	6(40.0)
I was able to master the exercise at the end of the program	-	1 (6.7)	7 (46.7)	7 (46.7)

I enjoyed taking in the exercise program	-	-	3 (20.0)	12 (80.0)
I would continue with the exercise program	-	1 (6.7)	7 (46.7)	7 (46.7)

308 *Abbreviation: HBA = Healthy Beat Acupunch*

309

310 The majority of participants agree or strongly agree with the appropriateness of the
 311 length of exercise program as well as the frequency, duration and size of exercise class with
 312 the majority suggesting ten to twelve people per class would be ideal (refer to Table 5). Only
 313 one participant felt the exercise motions were difficult to learn while the majority of
 314 participants indicated that they were able to master the exercise at the end of the program
 315 and the pace of the exercise was good. The trainer was highly regarded by all participants
 316 who felt that not only was she clear in her instructions and demonstrations of the exercise
 317 motions, she supported and helped them in their mastery of the exercise motions. All
 318 participants enjoyed the exercise program, and the majority of them would continue or
 319 recommend it to their friends. They also felt that their health has improved after completing
 320 the HBA exercise.

321 **4.0 Discussion**

322 Exercise is important to maintain functional independence and improve health and well-being
 323 in older adults [2], particularly when combating age-related sarcopenia [3]. However, reduced
 324 physical capacity of frail older adults and those with sarcopenia is not always considered in
 325 the design of exercises [7, 26]. The Healthy Beat Acupunch (HBA) exercise program has been
 326 developed based on acupoint stimulation and the exercise principles of acupunch while taking
 327 into account the physical exercise guidelines for older adults [12]. However, the evidence to
 328 support its appropriateness, particularly for older adults with reduced capacity (e.g. physical
 329 impairment or sarcopenia) or from a western culture has yet to be established. Therefore, in

330 our Delphi study, we sought first to validate the HBA program for older adults with sarcopenia
331 using a group of experts. The main concern highlighted during the Delphi study was with
332 regards to the execution of the HBA exercise motions by older adults with balance problems.
333 This concern was satisfactorily resolved with the inclusion of a chair for balance support if
334 required, when practising the motions. Following two rounds of Delphi communication,
335 experts' consensus was attained where the HBA program was validated and deemed to be
336 simple, safe, suitable and helpful for practice by older adults with sarcopenia.

337 Second, with the exception of recruitment (*which will be discussed in the next section*),
338 feasibility in terms of retention, adherence, safety, mastery and data collection were
339 established for the HBA exercise protocol in our Australian study. Participants affirmed the
340 HBA program and supported the frequency, duration and size of the exercise class. They were
341 appreciative of the trainer's support and instructions in learning the exercise which they
342 generally found easy to master. Not only did participants enjoy the HBA program, they
343 indicated that they plan to continue and recommend it to their friends. Importantly,
344 improvement in participants' gait speed was found post-exercise intervention, which is
345 congruent with participants' self-reported health improvement upon their completion of the
346 HBA program. The outcomes of our feasibility study are in line with the results from a
347 preliminary feasibility study of community older adults [12-14] where positive health
348 outcomes were reported. Overall, there appears to be preliminary evidence to suggest
349 support for the HBA program to improve gait speed of older adults, particularly those with
350 reduced physical capacity and probable sarcopenia or from a western culture.

351 **4.1 Feasibility of Recruitment**

352 A significant challenge in recruiting participants with sarcopenia was encountered. None of
353 our potential participants met the sarcopenia criteria in accordance with the EWGSOP2

354 guidelines [4], but could be considered to have probable sarcopenia and/or exhibiting low
355 gait speed that reflects frailty. Thus, several issues were taken into consideration when
356 determining their eligibility to participate in the feasibility study. First, the relationship
357 between sarcopenia and functional dependence is influenced by gait speed [24, 25]. Second,
358 even though the application of EWGSOP2 criteria for sarcopenia may be more cost and
359 resource effective than the use of EWGSOP1, there are suggestions that the number of
360 sarcopenia cases detected (i.e. sensitivity) can be lower when using EWGSOP2 in the geriatric
361 population, especially for men [28]. Third, lower gait speed in older adults may be explained
362 by the greater loss of muscle strength and mass in the legs (i.e. lower body) [29] than the
363 upper body due to a decrease in weight-bearing physical activities such as walking and
364 running affecting the lower limbs [30-34]. Consequently, older adults with weaker lower limbs
365 are then likely to compensate with upper limb effort when rising from a chair, or altering their
366 behaviour, such as using an elevator or lift instead of climbing the stairs, or parking close to
367 an entrance to avoid walking a long distance [35]. These would result in the regular and
368 consistent use of the upper body muscle groups and may help maintain muscle mass and
369 strength in the upper rather than lower body [36]. The BIA scale used, while generally a valid
370 measure of body composition, only detects overall body muscle mass and does not
371 differentiate between muscle mass in the upper and lower body and can be influenced by
372 various factors including environment and individual characteristics such as nutrition and
373 ethnicity that were not accounted for in the feasibility study. Therefore, potential participants
374 who had probable sarcopenia or low gait speed were included in the feasibility study.

375 **4.2 Limitations**

376 Validation of the HBA program may be limited by the small number of experts involved in the
377 Delphi study. Nevertheless, experts in our study reflected a range of professions and

378 experience including older adults with sarcopenia, where responses in *Round 1* Delphi were
379 mostly congruent with a consensus readily achieved in the *Round 2* Delphi. It should also be
380 noted that the HBA program is only validated for older adults with sarcopenia who are able
381 to stand and are not wheelchair-bound. Maeda and his colleagues [27] reported a high
382 prevalence of sarcopenia in older adults who are walking with aids (76.1%), wheelchair-bound
383 (89.4%) or immobile (91.7%). Hence, a different version of the HBA program, suitable for
384 practice by older adults with sarcopenia who are unable to stand or walk independently
385 without assistive devices, or are wheelchair-bound, is therefore needed.

386 Lastly, the improvement found in gait speed for participants following completion of
387 the HBA program needs to be cautiously interpreted given the shortcomings of the study
388 design, such as an inability to establish cause and effect with the small sample size as well as
389 the lack of consideration given to participants' exercise habits in the analysis.

390 **5.0 Conclusions**

391 The HBA exercise program was found to be an appropriate (i.e. simple, safe, suitable and
392 helpful) exercise program for practice by older adults, particularly those with reduced physical
393 capacity and probable sarcopenia or from a western culture. Reported research limitations
394 (i.e. study design, sample size) and challenge (i.e. participant recruitment) should be
395 considered when planning future studies assessing the effects of the HBA program.

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