

Strength and conditioning (S&C) practices of judo athletes and S&C coaches: a survey-based investigation

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1 **STRENGTH AND CONDITIONING (S&C) PRACTICES OF JUDO ATHLETES**
2 **AND S&C COACHES: A SURVEY-BASED INVESTIGATION**

3
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35 **ABSTRACT**

36 The benefits of strength and conditioning (S&C) for improving judo performance and reducing
37 injuries have been widely studied. However, the S&C practices employed and perspectives
38 held by those delivering S&C have yet to be elucidated. Therefore, this study investigated the
39 S&C practices and perspectives of judokas and S&C coaches working within judo. Forty-two
40 judokas and nine S&C coaches completed an online survey comprising six sections: (a) written
41 informed consent; (b) background information; (c) education, qualifications, and prescription;
42 (d) views on S&C; (e) exercise selection; and (f) issues and improvements. Frequency analysis
43 was used to report responses to fixed-response questions, and thematic analysis for open-ended
44 questions. Results indicated that S&C coaches were primarily responsible for delivering S&C
45 programs (60%), and S&C information was predominantly sourced from S&C coaches (43%).
46 Strength and conditioning was deemed *very important* for *randori* (78-88%), overall judo-
47 performance (67-79%), and judo-fitness (62-78%). Similarly, S&C was considered *very*
48 *important* for the development of speed and power (76-89%), strength (71-89%), and injury
49 reduction (69-78%). Novel findings were also observed, such as integrating judo-specific
50 training within S&C practice, which may be partly explained by more S&C coaches holding
51 judo belts (67%) than S&C qualifications (11%). **This study supports practitioners delivering
52 S&C in judo** by offering a base of information to critique or align with their existing S&C
53 practices and perspectives. Furthermore, our results may help identify potential gaps between
54 methods used, proposed guidelines, and actual practice, facilitating the development of
55 research and education resources tailored to the current climate.

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57 **Key Words:** survey; exercise selection; physical development; programming; physical testing.

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68 **Introduction**

69 Judo is a combat sport contested at the Olympic and Paralympic Games since 1964 and 1988,
70 respectively. Judo participation continues to grow with an increased number of judokas
71 competing in high-level competitions (e.g., world judo events) (37). Successful judokas
72 demonstrate superior technical and tactical skills, including grips (i.e., kumi-kata), feints, and
73 transition to groundwork (21,35,38,53), and can repeat such skills over a competition (48).
74 These demands have increased due to rule changes whereby a 4-minute match can be extended
75 indefinitely until a winner prevails (35). To support these extensive physical demands, judokas
76 should possess well-adapted physiological (19), physical (36), neuromuscular (14), and
77 psychological (69) attributes.

78
79 Activity-to-recovery ratios in competitive judo matches range from 2:1 to 3:1, which requires
80 judokas to possess a large aerobic capacity to recover from repetitive high-intensity actions
81 (48,50). This is further explained by the energy system requirements during competitive judo
82 matches, including 70% contribution via the oxidative system, 21% from ATP-PCr, and 8%
83 via anaerobic glycolysis (32). Other important attributes such as handgrip strength and
84 endurance, lower limb force production (39,41), and ability to sustain critical velocity (22)
85 underpin the repetitive execution of technical actions (e.g., grips, feints, throws) (48). Research
86 has shown that ~50% of effective attacks performed in official judo competitions were related
87 to judokas' performance in physical tests (e.g., handgrip strength and countermovement jump)
88 (36). **Therefore, developing the aforementioned attributes via strength and conditioning**
89 **training (S&C) may give judokas a competitive advantage.**

90
91 Judokas who experience consistently large spikes in training and competition loads are more
92 susceptible to fatigue and are exposed to situations that may cause injury (e.g., **being involved**
93 **in or defending powerful throwing techniques**) (4,11,40). Given the importance of injury
94 reduction to judokas, this topic has been widely studied (4,49,55). Longitudinal data between
95 2005-2020 highlighted that 28,297 top European judokas across 128 competitions registered
96 699 injuries (4). Of these injuries, the most common sites included the knee (17%), shoulder
97 (16%), and elbow (14%), with the most frequently reported injuries being sprains (42%) and
98 contusions (23%) (4). Various methods are suggested to reduce injury occurrence among
99 judokas, such as rule changes, technique improvement, and physical development/preparation
100 (55). Accordingly, specific injury prevention programs have been created, focusing on the

101 physical preparation of judokas, such as the IPPON warm-up program (24). This program
102 includes exercises that improve flexibility, agility, balance, coordination, strength, and
103 stability, which are considered essential for judo performance and injury reduction (24).

104

105 To prepare judokas for the demands of competition and reduce injury occurrence, there is a
106 need for the wider support team (e.g., judo coaches, S&C coaches, and physiotherapists) to
107 work cohesively (57). A key member of this team is the S&C coach, who uses assessments to
108 test the physical performance (38) and potential injury risk (24,46) of judokas. Hereafter, the
109 S&C coach can use testing data, amongst other methods, to design, monitor, and evaluate
110 training programs (3,10,45,58) to help judokas maintain and maximize their physical
111 capabilities (47). To inform the practices of S&C coaches, considering the perspectives of
112 sports coaches and athletes may help optimize the efficacy and adherence to S&C training
113 programs and foster stronger relationships (57,60,66,67).

114

115 Accordingly, a growing body of research has emerged investigating the S&C practices and
116 perspectives of athletes and S&C coaches across different sports (e.g., soccer, cricket, rugby,
117 track and field) (43,44,65–68). This research is important, as it helps identify the utilization of
118 contemporary S&C practices and establish whether these align with S&C guidelines and
119 research or if alternative and anecdotal methods are preferred. The consensus amongst these
120 studies is the critical role S&C plays in the physical development of athletes, which can
121 underpin the performance of sports-specific actions and reduce injury risk. However, there is
122 limited evidence on this topic area in combat sports beyond wrestling (30). Consequently, it is
123 uncertain what S&C practices are employed in other combat sports, such as judo. This requires
124 further investigation, given the potential importance of S&C for various physical and
125 physiological factors associated with superior judo performance, as highlighted previously
126 (e.g., strength, power, speed, and injury reduction) (22,24,39–41). Therefore, the present study
127 investigated the S&C practices and perspectives of judokas and S&C coaches working within
128 the sport. The results of this investigation may help identify potential gaps between methods
129 used, proposed guidelines, and actual practice, facilitating the development of research and
130 education resources tailored to the current climate.

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133

134 **Table 1.** Definitions of judo terminology.

Term	Definition
Harai-goshi	Hip throw technique
Kumi-kata	Fighting grips
Kuzushi	Breaking opponents balance
Morote-seoi-nage	Shoulder throw technique
Nage-Komi	Repetitive throwing
Ne-Waza	Groundwork fighting
O-soto-gari	Foot throw technique
Ouchi-gari	Foot throw technique
Randori	Free Fighting
Sasae-tsurikomi-ashi	Foot throw technique
Uchikomi	Repetition training

135

136 **Methods**137 *Experimental Approach to the Problem*

138 This cross-sectional survey study investigated the S&C practices and perspectives of judokas
139 and S&C coaches from different countries and levels.

140

141 *Subjects*

142 Forty-two judokas ($n = 32$ male, $n = 9$ female, $n = 1$ non-disclosed; age: 29 ± 10 yrs, range:
143 18 to 61 yrs) and nine S&C coaches ($n = 9$ male; age: 39.6 ± 9.4 yrs, range: 27 to 54 yrs)
144 participated in this study.

145

146 *Procedure*

147 The anonymous online surveys used in this study were adapted from prior research across
148 various sports (44,65,68) and developed using the survey application Google Forms (Alphabet
149 Inc, USA). The surveys designed in the above studies underwent pilot testing with experienced
150 researchers, practitioners (e.g., S&C coaches, sports coaches), and athletes to assess for content
151 validity. For this study, surveys were initially written in English and translated into Portuguese.
152 Hereafter, the survey's content validity was evaluated by each research team member, three
153 judokas, and three S&C coaches through pilot testing before being finalized. This led to minor
154 changes in some questions' wording and structure to ensure they were clear and appropriate for
155 the surveyed population. Six sections were included in the surveys, (a) written informed
156 consent; (b) background information; (c) education, qualifications, and prescription; (d) views
157 on S&C; (e) exercise selection; and (f) issues and improvements. Both (judoka and S&C coach)
158 surveys included 13 fixed responses and 12 open-ended questions (see appendix).

159

160 A digital invitation letter was emailed to prospective participants through various
channels to access the surveys (e.g., judo governing bodies and professional networks). The

161 surveys detailed the inclusion criteria, purpose, aims, required time commitment, and
162 confidentiality of responses, to help participants provide consent. The inclusion criteria for
163 judokas were: (a) 18 years of age or above, (b) currently competing in competitive standard
164 judo, and (c) currently involved in an S&C program. For S&C coaches, the inclusion criteria
165 were: (a) 18 years of age or above, (b) currently working in competitive-standard judo, and (c)
166 currently prescribing S&C programs to competitive-standard judokas. The Human Subjects
167 Ethics Sub-Committee of *****REMOVED FOR PEER REVIEW***** approved this study,
168 which was conducted per the Declaration of Helsinki.

169

170 *Statistical Analyses*

171 All survey responses were downloaded into a Microsoft Excel Spreadsheet (**version 16.68,**
172 **USA**). Fixed-response questions were assessed using frequency analysis. Open-ended response
173 questions were initially evaluated by the lead author following a six-stage thematic analysis
174 process, (a) familiarization with the data; (b) generating initial codes; (c) searching for themes;
175 (d) reviewing themes; (e) defining and naming themes; and (f) producing the report (6,7).
176 Hereafter, each theme and pattern emerging from the raw data were discussed, reviewed, and
177 agreed upon by all co-authors who have extensive experience as practitioners and athletes in
178 judo and other combat sports. This thematic analysis method has been used in prior studies
179 surveying sports coaches, athletes, and S&C coaches (27,56,64,67).

180

181 **Results**

182 *Participant Geolocation and Experience*

183 Judoka participants were geographically based in Brazil (50%), the United Kingdom (24%),
184 Spain (7%), Hong Kong (SAR China), Japan, Australia, India, Canada, Haiti, Zambia, and
185 Ethiopia (all 2%). S&C coaches were located in Brazil (67%), the United Kingdom (22%), and
186 Serbia (11%). Participants' experience working in judo was **15 ± 9.5 yrs (range: 1 to 50 yrs)**
187 **for judokas and 15.2 ± 12.3 yrs (range: 4 to 35 yrs) for S&C coaches**. Judokas self-reported
188 competition standards were international (38%), national (45%), regional (5%), state (7%), and
189 municipal (2%). Strength and conditioning coaches provided support to judokas at international
190 (56%), national (33%), and state (11%) standards.

191

192 *Education, Qualifications, and Prescription*

193 Judokas' highest levels of education were bachelor's degree (55%), secondary school (21%),
194 master's degree (12%), higher diploma/associate degree (7%), and Doctor of Philosophy
195 (Ph.D.) (5%), with 41% of qualifications in sports or physical education-related fields. S&C
196 coaches highest levels of education were bachelor's degree (44%), master's degree (33%), and
197 Ph.D. (22%), with 100% of qualifications in sports or physical education-related fields.
198 Qualifications in S&C were held by 9% of judokas, with the National Strength and
199 Conditioning Association (NSCA) (7%), and Australian Strength and Conditioning
200 Association (ASCA) (2%), respectively. **Only 11% of S&C coaches held S&C qualifications**
201 **and were based in the United Kingdom and accredited by the United Kingdom Strength and**
202 **Conditioning Association (UKSCA).** The judo belts held by judokas were brown (43%), black
203 1st dan (26%), black 2nd dan (10%), black 3rd dan (7%), black 5th dan (5%), and coral 6th dan,
204 black 4th dan, orange, and blue (all 2%). The judo belts held by 67% of S&C coaches were
205 black 4th dan (33%), black 2nd dan (22%), and black 3rd dan (11%).

206

207 According to judokas, S&C coaches (60%) were primarily responsible for prescribing S&C
208 programs, and to a less extent by head coaches (21%), independently by judokas (12%), and
209 trainers (7%). Besides their programming, S&C coaches reported that the other personnel
210 responsible for prescribing S&C programs were head coaches (78%), and independently by
211 judokas and trainers (both 11%). The percentage of judokas and S&C coaches reporting where
212 they predominantly sourced S&C information is presented in Figure 1.

213

214 *Views on Strength and Conditioning*

215 The perceptions of judokas and S&C coaches regarding the importance of S&C for different
216 judo and physical components are presented in Figures 2 and 3, respectively.

217

218 Overall, when asked how effective their S&C training programs were, judokas reported
219 moderately effective (31%), very effective (26%), effective (26%), slightly effective (14%),
220 and not effective (2%). Whereas S&C coaches reported mostly effective (44%), very effective
221 (33%), and moderately effective (22%). Exemplar responses are provided below.

222

223 *Judoka (positive), "An increase in strength, power, and endurance that can be seen in*
224 *judo performance. Lower injury rate and quicker return to play after injury"* and *"After*

225 *specific strength training for judo, I felt a big difference in technical/randori training,*
226 *especially in kumi-kata”.*

227

228 Judoka (constructive), *“My coaches and fellow athletes have a limited understanding*
229 *of S&C”, “Lacking consistency of S&C training”, and “Limited access to resources”.*

230

231 S&C coach (positive), *“S&C is well incorporated into my athlete's annual training*
232 *plan, including skill training and the International Judo Federation (IJF) competition*
233 *system” and “S&C is extremely important for our competitive athletes, conditioning*
234 *accounts for about 50% of the total preparation time for competition”.*

235

236 S&C coach (constructive), *“Time is limited as is monitoring load” and “Could be more*
237 *effective if we had a better infrastructure”.*

238

239 Judokas and S&C coaches described their views on S&C for judo, with exemplar responses
240 provided below.

241

242 Judoka (positive), *“It is now mandatory for judokas to undertake S&C and be physically*
243 *prepared to win in high-level judo competition and remain injury free” and “S&C is*
244 *often underutilized. It improves speed, power, agility, and conditioning, which allows*
245 *for higher quality technical practice and better execution of techniques”.*

246

247 Judoka (constructive), *“Unfortunately, there is a severe lack of understanding and*
248 *education around S&C in judo at a grassroots level” and “Few technicians know how*
249 *to prescribe S&C training for judo. They try to apply new things in their dojos by*
250 *reproducing what they see, but without knowing why or reflecting on their practice”.*

251

252 S&C coach (positive), *“You cannot perform in judo without specific physical training.*
253 *At the highest level, the ability to produce and sustain force is one of the main predictors*
254 *of success” and “Many of the characteristics and actions required for judo can be*
255 *developed during S&C practice”.*

256

257 S&C coach (constructive), *“The challenge is balancing mat-based load with S&C*
258 *training”* and *“S&C is widespread, but there are limited resources for its application”*.

259

260 *Exercise Selection and Preferences*

261 The exercise preferences of judokas and S&C coaches for different areas related to judo
262 performance are presented in Table 2, with exemplar responses for the highest-ranked exercises
263 provided below.

264

265 Strength (deadlift)

266 Judoka, *“It is a whole body exercise, which covers the muscles used for throwing”*.

267

268 S&C coach, *“A very complete exercise that can be modified to focus on different areas*
269 *of strength, including the grip and posterior chain”*.

270

271 Speed and Power (weightlifting):

272 Judoka, *“Is a total body exercise and is great for developing rate of force production”*.

273

274 S&C coach, *“The movement of hip extension and transfer of force is important for*
275 *judokas and has similarities with the extension occurring in throwing”*.

276

277 Agility (judo-specific movements):

278 Judoka, *“Banded uchikomi is highly specific, allowing the judoka to move explosively*
279 *in the pattern of the throw being practiced”*.

280

281 S&C coach, *“Specific transfer to judo techniques”*.

282

283 Judo-specific fitness (judo-specific movements):

284 Judoka, *“Tabata uchikomi drill”*

285

286 S&C coach, *“Mat-based conditioning”*.

287

288 Judo-Specific Injury Reduction: differences were observed between judokas and S&C coaches
289 for the most important exercise. Judokas presented a broad range of responses falling into the

290 miscellaneous category, which included “*Elastic band exercises*” and “*A good warm-up*”.
291 Whereas the most important exercises reported by S&C coaches were categorized into general
292 strength, which included “*Eccentric strength exercises*” and “*Turkish get up*”.

293

294 *Issues and Improvements*

295 Perceived issues, disadvantages, desired improvements, and future developments regarding the
296 S&C of judokas and S&C coaches in judo are presented in Table 3.

Table 2. Preferred exercises of judokas ($n = 42$) and strength and conditioning coaches ($n = 9$) for different areas related to judo performance.

Area	Rank	Exercise		1 st Most Important Exercise (%)	2 nd Most Important Exercise (%)	3 rd Most Important Exercise (%)
Strength	1	Deadlift and Variations	Judoka	24	5	7
			S&C Coach	56	11	0
	2	Squat and Variations	Judoka	21	14	19
			S&C Coach	11	33	22
	3	Bench Press (including push-ups)	Judoka	17	29	17
			S&C Coach	11	11	22
	4	Rowing (e.g., barbell)	Judoka	12	7	12
			S&C Coach	11	0	22
	5	Weightlifting and Derivatives	Judoka	12	10	5
			S&C Coach	0	0	0
	6	Pull-up	Judoka	7	7	5
S&C Coach			11	44	11	
7	Miscellaneous (e.g., specific strength training)	Judoka	5	14	17	
		S&C Coach	0	0	11	
8	Judo-Specific Movement	Judoka	2	2	0	
		S&C Coach	0	0	11	
9	No Answer	Judoka	0	7	7	
		S&C Coach	0	0	0	
10	Core (e.g., Russian twist)	Judoka	0	2	7	
		S&C Coach	0	0	0	
11	Plyometrics (e.g., single-leg hop)	Judoka	0	2	5	
		S&C Coach	0	0	0	

Speed and Power	1	Weightlifting and Derivatives	Judoka	21	19	14
			S&C Coach	78	56	11
	2	Judo-Specific Movement	Judoka	21	7	5
			S&C Coach	0	0	11
	3	Sprint	Judoka	14	5	2
			S&C Coach	11	0	0
	4	Plyometrics (e.g., box jump)	Judoka	12	7	10
			S&C Coach	11	22	22
	5	Miscellaneous (e.g., circuit exercises)	Judoka	10	14	14
			S&C Coach	0	22	0
	6	Rowing (e.g., barbell)	Judoka	5	5	2
			S&C Coach	0	0	0
7	Deadlift and Variations	Judoka	5	2	0	
		S&C Coach	0	0	11	
8	Ballistics (e.g., medicine ball throw)	Judoka	5	0	5	
		S&C Coach	0	0	44	
9	Squat and Variations	Judoka	2	7	5	
		S&C Coach	0	0	0	
10	Bench Press (including push-ups)	Judoka	2	2	5	
		S&C Coach	0	0	0	
11	Pull-up	Judoka	2	2	0	
		S&C Coach	0	0	0	
12	No Answer	Judoka	0	29	38	
		S&C Coach	0	0	0	
Agility	1	Judo-Specific Movement	Judoka	29	0	0

		S&C Coach	44	22	11
		Judoka	19	14	5
2	Coordination (e.g., foot, hand, eye)	S&C Coach	0	0	11
		Judoka	12	10	10
3	Plyometrics (e.g., horizontal jump)	S&C Coach	33	33	44
		Judoka	12	2	5
4	Sprint	S&C Coach	0	11	0
		Judoka	12	5	2
5	Miscellaneous (e.g., resistance band exercise)	S&C Coach	0	0	0
		Judoka	7	57	69
6	No Answer	S&C Coach	0	22	22
		Judoka	5	2	0
7	Weightlifting and Derivatives	S&C Coach	0	0	0
		Judoka	2	7	2
8	Change of direction (e.g., 505)	S&C Coach	22	11	11
		Judoka	2	2	7
9	Strength (e.g., lateral lunge)	S&C Coach	0	0	0
<hr/>					
		Judoka	21	12	10
1	Miscellaneous	S&C Coach	11	11	0
		Judoka	17	10	10
Judo-Specific	2	S&C Coach	0	0	0
		Judoka	12	31	52
Injury Reduction	3	S&C Coach	0	0	0
		Judoka	12	7	0
	4	S&C Coach	22	11	11
		Judoka	12	7	0
		S&C Coach	22	11	11

	5	Strength – General	Judoka	12	0	0
			S&C Coach	33	11	11
	6	Stretching/Mobility	Judoka	10	0	0
			S&C Coach	0	22	11
	7	Balance/Proprioception (e.g., single leg balance)	Judoka	7	17	2
			S&C Coach	0	0	22
	8	Core (e.g., plank)	Judoka	5	2	0
			S&C Coach	11	11	22
	9	Judo-Specific Movement	Judoka	5	0	5
			S&C Coach	0	0	0
	10	Strength - Shoulder (e.g., external rotation)	Judoka	0	10	7
			S&C Coach	11	0	22
	11	Deadlift and Variations	Judoka	0	5	0
			S&C Coach	11	33	0
	12	Strength - Isolation (e.g., neck)	Judoka	0	2	7
			S&C Coach	0	0	0
	13	Bench Press (including push-ups)	Judoka	0	2	5
			S&C Coach	0	0	0
	14	Weightlifting and Derivatives	Judoka	0	2	2
			S&C Coach	0	0	0
			Judoka	43	26	26
Judo-Specific	1	Judo-Specific Movement	S&C Coach	56	33	11
Fitness	2	No Answer	Judoka	10	38	38
			S&C Coach	0	11	22
	3	Grip (e.g., judogi pull-up)	Judoka	10	2	2

		S&C Coach	0	0	0
4	Sprint	Judoka	14	2	5
		S&C Coach	0	0	11
5	Miscellaneous (e.g., Wingate)	Judoka	7	19	12
		S&C Coach	22	22	33
6	Plyometrics (e.g., squat jump)	Judoka	5	5	5
		S&C Coach	0	11	11
7	Ballistics (e.g., kettlebell swing)	Judoka	5	2	0
		S&C Coach	0	0	0
8	Circuit Training	Judoka	2	2	5
		S&C Coach	22	11	0
9	Squat and Variations	Judoka	2	2	2
		S&C Coach	0	0	0
10	Bench Press (including push-ups)	Judoka	2	0	5
		S&C Coach	0	11	11

Numbers in bold indicate the most common response.

Note: S&C: strength and conditioning.

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Table 3. Judokas ($n = 42$) and strength and conditioning coaches ($n = 9$) responses to their perceived issues, disadvantages, desired improvements, and future developments regarding strength and conditioning in judo.

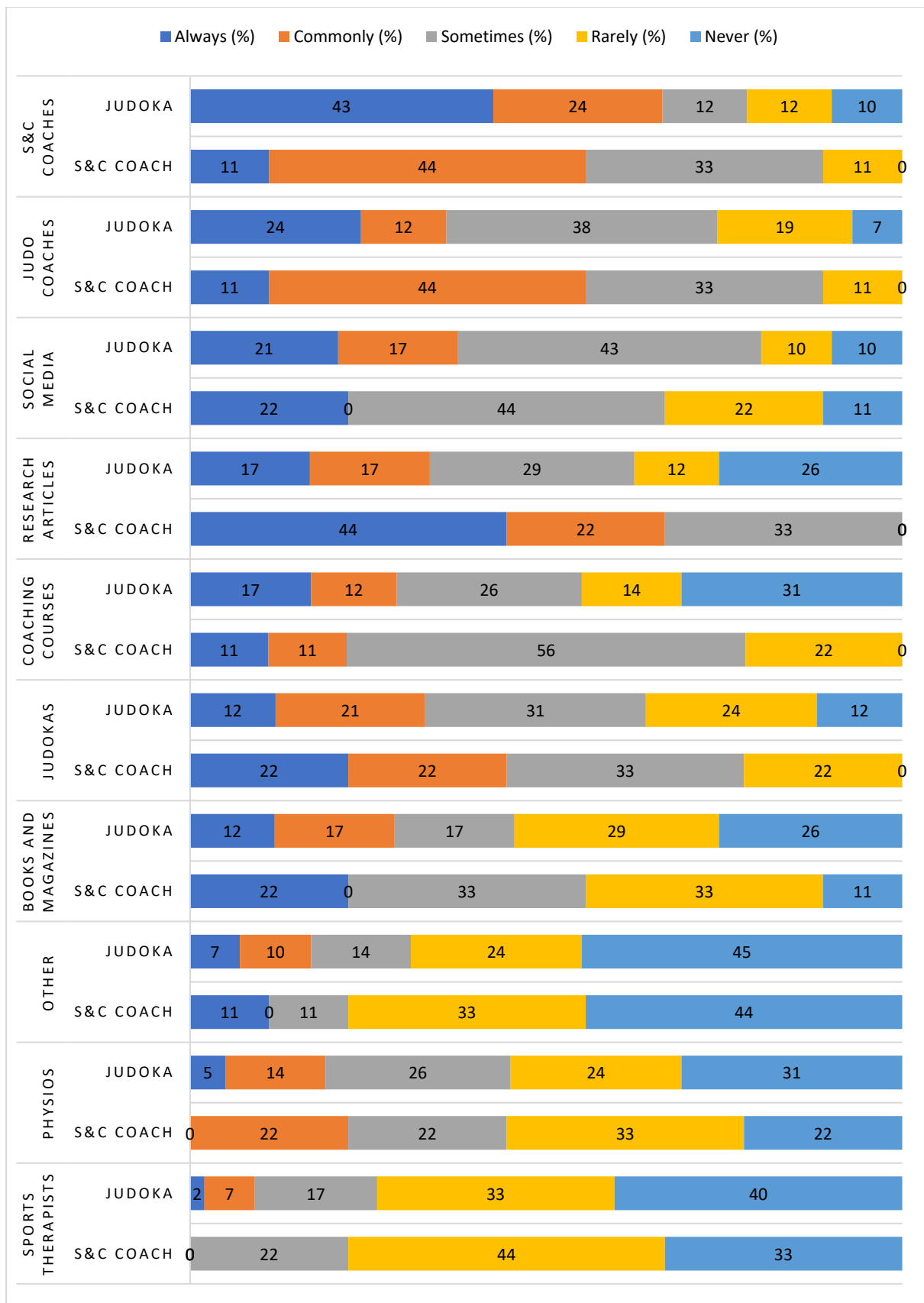
	Rank	Theme	Exemplar Response	Judoka (%)	S&C Coach (%)
Issues	1	Periodization	“Difficult to strike a balance between S&C and judo practice”	19	44
	2	Fatigue	“Athletes present a lot of fatigue and micro-injuries after judo training”	19	11
	3	Insufficient Time	“When combined with randori and travel, time management is an issue”	14	22
	4	Facilities/Resources	“Lack of specific equipment”	10	0
	5	No Answer		12	0
	6	Injury	“Coming back from a bilateral shoulder injury, I feel some restriction in movement”	10	0
	7	Technical Understanding of S&C	“Athletes are unfamiliar with basic exercises”	7	11
	8	Motivation	“How to stimulate and motivate the athlete within the S&C training period”	7	11
	9	Miscellaneous	“Weight gain”	2	0
Disadvantages	1	No Disadvantages	“I think there are no downsides to S&C”	21	11
	2	Fatigue	“If not programmed correctly it can lead to an accumulation of fatigue and increase the likelihood of injury”	19	0
	3	Injury	“Injuries may occur when exercises are not performed well or not enough rest time”	17	11
	4	Non Judo-Specific	“When you train with barbells, you become a barbell. It's difficult to train	12	11

	5	Insufficient Time	reactive strength when the bar is solid and doesn't move unpredictably like a human” “Leads to less time to do judo”	7	0
	6	Technical Understanding of S&C	“Not knowing how much weight you can lift without an S&C coach present all the time”	7	0
	7	Miscellaneous	“Lack of funds”	7	11
	8	Weight Reduction	“Gaining muscle mass can take the athlete over the weight limit for their category”	7	11
	9	Periodization	“Balance of load from mat-based training, travel, and competition	2	44
	1	Periodization	“More regular communication to identify fatigue levels and progress or regress exercises accordingly”	24	44
	2	Miscellaneous	“More S&C coaches, more resources, and more continued professional development for S&C coaches in combat sport”	21	11
Improvements	3	Increased Number of S&C Sessions	“More sessions, so I can lift in the morning and do judo practice at night. Off days would be weekends, where I can do light cardio and mobility”	17	0
	4	Judo-Specific S&C Movements/Equipment	“I would develop updated judo tests and create ergonomically designed machines to execute judo-specific movements”	12	33

	5	Athlete Education	“More theoretical training for athletes, to raise awareness of the importance of strength training and its correct application”	10	0
	6	Greater Focus - Agility	“Set more agility training to improve my area of weakness”	5	0
	7	Greater Focus - Strength	“More time to train strength”	7	0
	8	Technology Integration	“I would use technology to help with training”	2	11
	9	No Answer		2	0
	1	Judo-Specific S&C Training	“A United Kingdom based group looking specifically at S&C in combat sport (judo)”	26	33
	2	No Answer		21	11
	3	Miscellaneous	“Improved diet and supplementation”	17	22
	4	Greater Focus - Strength Training	“More strength training”	10	0
Future	5	Athlete Education	“Provide videos and resources for judo S&C”	7	0
	6	Greater Focus - Fitness Training	“Integrate high-intensity interval training”	5	0
	7	Technology Integration	“Platforms, sensors, and technological devices where results are reliable and extracted in real time”	5	33
	8	Greater Focus - Power Training	“More explosive type training”	5	0
	9	Greater Focus - Agility Training	“Increased agility training”	2	0
	10	Greater Focus - Flexibility Training	“More flexibility to reduce injuries”	2	0

303 Numbers in bold indicate the most common response.

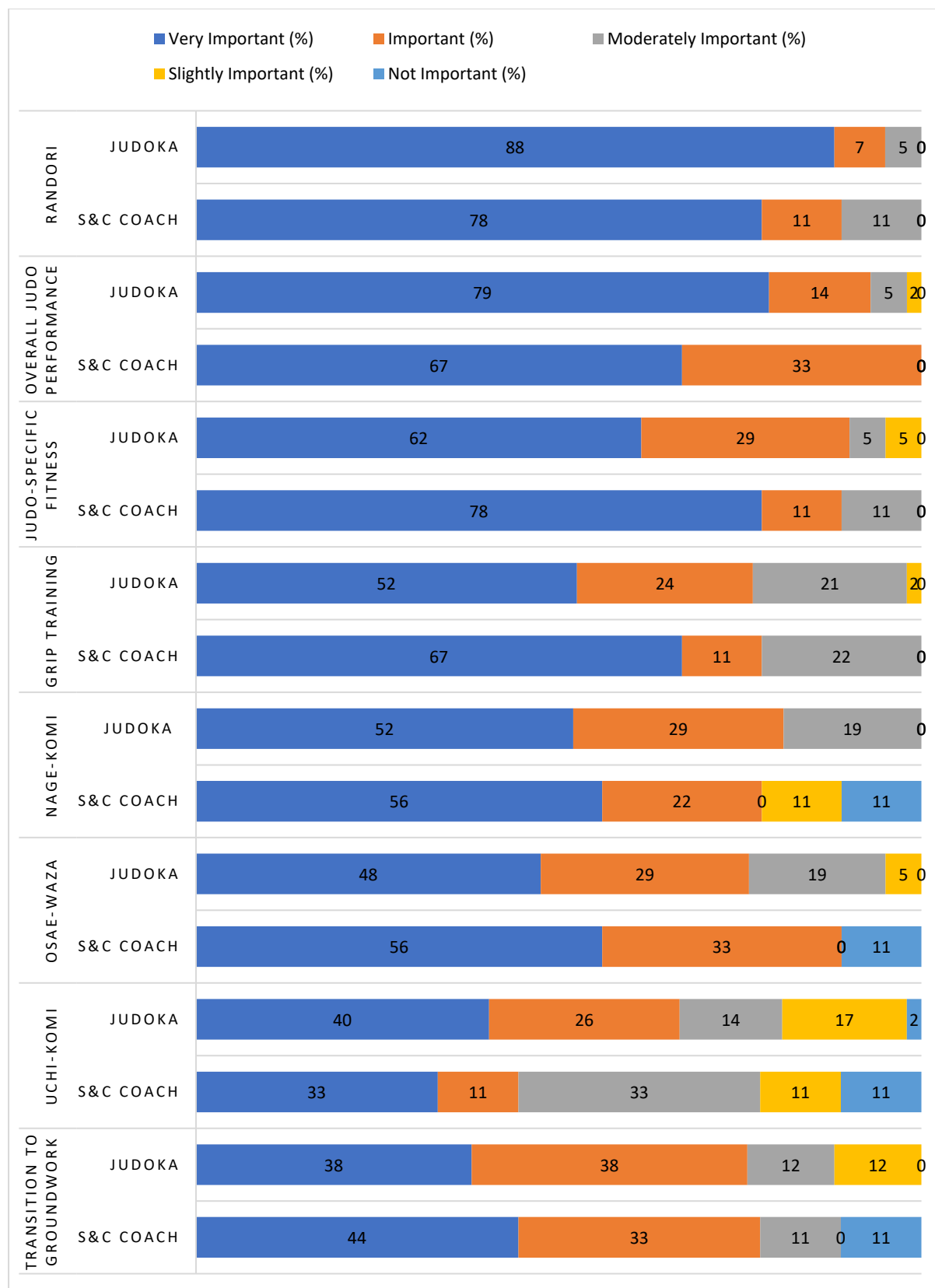
304 Note: S&C: strength and conditioning



305

306 Figure 1. Where judokas ($n = 42$) and strength and conditioning coaches ($n = 9$) predominantly source strength
 307 and conditioning information.

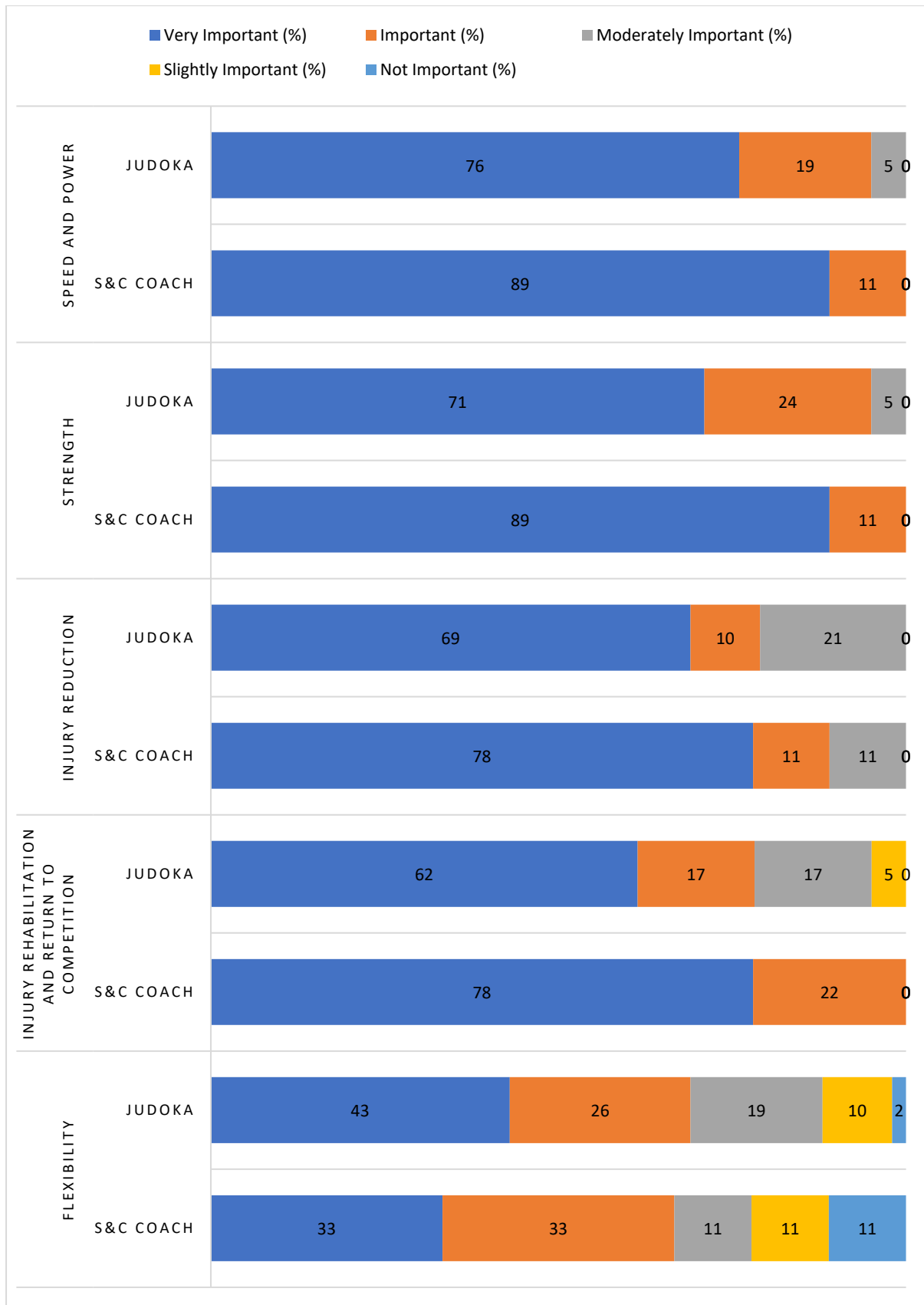
308 Note: S&C: strength and conditioning, Physios: physiotherapists.



309

310 Figure 2. Judokas ($n = 42$) and strength and conditioning coaches ($n = 9$) perceptions of the importance of strength
 311 and conditioning for different areas of judo.

312 Note: S&C: strength and conditioning, Randori: combat or fight practice, Nage-Komi: repetitive throwing
 313 training, Osae-Waza: hold down training, Uchi-Komi: repetitive technical training.



314

315 Figure 3. Judokas ($n = 42$) and strength and conditioning coaches ($n = 9$) perceptions of the importance of strength
 316 and conditioning for different physical components.

317 Note: S&C: strength and conditioning

318

319 **Discussion**

320 This survey study aimed to investigate and provide original evidence on the S&C practices and
321 perspectives of judokas and S&C coaches working within judo. Results indicated that S&C
322 coaches were primarily responsible for delivering S&C programs and that S&C information
323 was commonly sourced from S&C coaches and research articles, despite few S&C coaches
324 holding S&C qualifications. Strength and conditioning was deemed *important* to *very*
325 *important* for a range of judo-specific skills and physical abilities. Preferred exercises for
326 different areas associated with judo performance generally aligned with research
327 recommendations. However, novel and interesting findings were also found, possibly
328 associated with the unique nature of judo training and competition and the limited research on
329 this topic in judo and other combat sports. The information presented in this study can support
330 those working in judo by offering a base of knowledge to critique or align their existing S&C
331 practices. **Furthermore, it may direct future research concerning S&C in judo and inform**
332 **governing bodies' recommendations for professional practice, education, and qualifications.**

333

334 A key finding was that despite the importance placed on S&C for developing physical and
335 technical judo-related abilities (see Figures 2 and 3), only ~10% of all participants held S&C
336 qualifications. However, 100% of judokas and 67% of S&C coaches held judo belts, and >80%
337 had competed/worked in national-standard judo competitions and above. Accordingly, within
338 S&C training, judo-specific movements were extensively prescribed (see Table 2). Our
339 findings are in contrast to other sports where S&C coaches more commonly held S&C
340 qualifications, such as cricket (76%) (64), soccer (65%) (63), swimming (58%) (13), and rugby
341 union (56%) (31). Additionally, the possession of sport-specific qualifications of S&C coaches
342 in judo was greater (67%) than that reported by S&C coaches in soccer (54%) (63) and cricket
343 (40%) (64). Therefore, this may indicate that judokas and judo-based S&C coaches may
344 emphasize the transfer of physical development to the technical-tactical components of
345 performance.

346

347 Judokas reported that S&C programs were prescribed mainly by S&C coaches (60%), but this
348 still indicates that 40% of programs are delivered independently or by the wider support team.
349 **However, it appears a larger proportion of S&C programs are delivered by S&C coaches in**
350 **judo when compared to data reported by soccer (40%) and volleyball (47%) athletes in Hong**
351 **Kong (66,67).** It is widely recommended by organizations such as the NSCA that those

352 responsible for delivering S&C should hold relevant certifications through an accredited S&C
353 program (e.g., NSCA Certified Strength and Conditioning Specialist [CSCS]) to reduce the
354 risk of liability when supervising or instructing S&C sessions (59). However, a recent analysis
355 of job descriptions ($n = 50$) across five countries (United Kingdom, United States of America,
356 China, Singapore, and New Zealand) revealed that less than 50% of employers were seeking
357 applicants with S&C certifications (62). Within this study, only 26% of judokas reported their
358 S&C programs to be *very effective*, which could be related to the limited number of qualified
359 S&C coaches delivering programs. However, responses regarding the inefficacy of programs
360 were broad-ranging and included “*lacking consistency of S&C training*”, “*access to*
361 *resources*”, and “*time restrictions*”. Therefore, it would be valuable for future studies to
362 investigate whether programs delivered by those without professional training or certifications
363 in S&C influence aspects such as safety and the efficacy of S&C programs.

364

365 Judokas and S&C coaches across this study reported they predominantly source S&C
366 information from viable sources such as S&C coaches and research articles, whereas
367 approximately 1 in 5 uses social media. Similar findings were reported in grassroots soccer,
368 where coaches principally used highly accessible sources such as social media, websites, and
369 YouTube to inform their understanding and practice surrounding fundamental movement skills
370 (15). Although the evidence base of such resources may be questioned (15), it is essential to
371 acknowledge the need for highly accessible resources to improve the knowledge and practice
372 surrounding S&C in judo. Furthermore, with literature indicating that athletes spend more time
373 on mobile devices, this may be a more viable means of disseminating research-informed
374 guidance in S&C (25). Therefore, greater attention may be placed on the implementation and
375 effectiveness of social media as a tool for educating judokas and S&C coaches in judo.

376

377 Judokas and S&C coaches believed S&C was most important for improving *randori*
378 performance, while S&C coaches equally thought it was important for judo-specific fitness
379 (Figure 2). This acknowledges the vital contribution S&C plays in influencing certain aspects
380 of judo performance (e.g., aerobic and anaerobic fitness, grip strength, and rate of force
381 production). It has been reported that 70% of Olympic-standard judokas perform *randori* up to
382 seven times per week, due to its relevance to the demands of competitive judo matches (23).
383 The quantity, duration, and recovery periods used for *randori* can be manipulated to elicit
384 different physical, physiological, and perceptual responses to training (9). Accordingly, using

385 S&C (general preparation) and *randori* (specific preparation), judo-specific fitness can be
386 enhanced, which has been shown to underpin the execution of judo techniques and high-
387 intensity grip disputes (33,36) and be a discriminating factor between competitive standards
388 (e.g., national vs. regional) (20). For example, performance in neuromuscular tests (i.e.,
389 standing long jump, seated medicine ball throw, and handgrip strength) was moderately
390 correlated with the Special Judo Fitness Test (SJFT) and Judoji Grip Strength Test (JGST)
391 (42). Other research using the SJFT reported that judokas with superior performance were
392 significantly correlated with higher anaerobic thresholds, lower blood lactate accumulation,
393 and power production (14). Therefore, the perspectives of judokas and S&C coaches that S&C
394 can support the development *randori* performance and judo-specific fitness are congruent with
395 associated research.

396

397 The perception of judokas and S&C coaches indicated that S&C was important for strength,
398 speed, power, injury reduction, and injury rehabilitation/return to play, but to less extent for
399 improving flexibility (see Figure 3). The relationship between maximal force and rate of force
400 production on judo performance has been widely investigated, providing evidence that the
401 development of these physical attributes may transfer to judo-techniques (e.g., throwing: *harai-*
402 *goshi* [hip], *sasae-tsurikomi-ashi* [foot], *morote-seoi-nage* [shoulder]. For example, research
403 addressing the relationship between trunk muscle strength and judo-specific pulling
404 performances in judokas using a specially designed system mimicking the judo technique
405 *morote-seoi-nage* showed that the trunk flexors accounted for 69% of the mechanical work,
406 therefore, advising judokas to develop trunk muscle strength to support dynamic pulling
407 movements (29). Reducing the number and severity of injuries sustained by judoka and
408 accelerating return to competition from injury is of interest given the high prevalence of injuries
409 in judo, particularly in areas exposed to more significant stress and impacts during specific
410 techniques and combat (4,34,55). Accordingly, injury prevention programs have been
411 proposed that include judo-specific movements (e.g., leg techniques: *o-soto-gari* or *ouchi-*
412 *gari*), strength, balance, and body awareness in vulnerable positions (24,46). When asked
413 which S&C exercises are important for reducing judo-related injuries, judokas' most frequent
414 responses fell under the miscellaneous category, whereas S&C coaches reported general
415 strength. Given the broadness of these responses and the varied nature of injuries sustained in
416 judo, it may infer that there is no common consensus on the most appropriate exercises to
417 reduce injuries and that a more general or individualized approach to injury reduction may be

418 **avored.** Approximately two-thirds of participants in this study did not believe S&C was very
419 important for the development of flexibility, which is contrary to current research, which
420 suggests resistance exercises may improve flexibility and range of motion to similar effects as
421 static stretching (2,52). **This may indicate that research on specific topics regarding the benefits**
422 **of S&C for physical performance in judoka could be more effectively educated and**
423 **disseminated.**

424

425 Exercise preferences reported by participants were deadlift and variations for strength,
426 weightlifting and derivatives for speed and power, and judo-specific movements for agility and
427 **judo-sepcific fitness** (see Table 2). The deadlift being reported as the most important exercise
428 in judo is in contrast to S&C coaches in wrestling, who preferred the squat (30). However,
429 research suggests that both exercises can effectively improve lower body force production (54);
430 therefore, they are highly recommended as exercises in the S&C training programs of elite
431 judoka (26). Although there is limited evidence to suggest the direct benefits of weightlifting
432 on the performance of judoka, research on youth judoka and wrestling athletes demonstrated
433 that 12 weeks of weightlifting were >85% likely to improve (*moderate-large* effect size)
434 countermovement jump, horizontal jump, and sprinting (5m and 20m) performance (12).
435 Combining S&C with judo-specific training was common in the responses received throughout
436 this survey study. It has been suggested that judo-specific training should more prominently
437 occur during the specific preparation phase of an S&C training program, where the focus shifts
438 to judo-specific rate of force development and conditioning (26). For example, *nage-komi* can
439 improve aerobic and anaerobic fitness or *randori* to mimic the demands of judo matches (17).
440 Although highly judo-specific actions may appear beyond the scope of an S&C coach, given
441 the high prevalence of judo belts held by S&C coaches in this study, these exercises may be
442 effectively applied.

443

444 Judokas and S&C coaches reported that periodization was a significant issue and disadvantage
445 when implementing S&C and that this was an area for desired improvement. However, it is
446 uncertain from our findings whether this is associated with the ability of judokas and S&C
447 coaches to periodize S&C programs effectively or due to communication and logistical issues.
448 Desired improvements regarding periodization are logical given that research in judo has
449 demonstrated the efficacy of different periodization strategies during the annual training season
450 to improve physical performance (e.g., aerobic and anaerobic capacity, and number of throws

451 in a judo-specific test) (16,18,47). Research investigating the influence of different
452 periodization strategies (i.e., traditional vs. daily undulating) in adolescent elite judoka found
453 they were similar in developing one-repetition maximum strength from 5.5-13.5% in the squat,
454 bench press, bench pull, and lat pull-down movement, respectively (61). To monitor training
455 load, using ratings of perceived exertion (RPE) and session-RPE is effective across different
456 ages, genders, and standards (1,8). For example, Bromley et al. (8) reported good correlations
457 between session-RPE, lactate, and mental effort, with a single increase in reported RPE values
458 resulting in a 2.1 unit increase in physical and 1.4 unit increase in mental effort. Therefore,
459 using RPE may provide a simple and proactive approach to monitoring and adjusting training
460 load in judo and warrants further investigation.

461

462 Finally, it was widely proposed by judokas and S&C coaches that more judo-specific
463 equipment, movement, and training were needed. Prior research has shown that partner work
464 provides limited resistance during specific judo techniques; therefore, using specialized
465 equipment may enable more appropriate training methods. For example, Blais et al. (5)
466 developed a judo-specific machine that mimics the *morote-seoi-nage* throwing technique and
467 demonstrated that it can provide superior and progressive resistance compared to partner work.
468 Other research demonstrated the validity and reliability of a judo-specific ergometer (JERGo
469 system), which showed acceptable correlations ($r = 0.41-0.88$) for muscle activity during
470 *kuzushi* compared to partner work (28). Although this specialized equipment provides
471 promising results, the expense may limit their wider implementation. **To measure the efficacy
472 (i.e., improvements in speed, motion, or displacement) of judo-specific or alternative training
473 methods, cost-effective equipment such as linear position transducers (51) or mobile
474 applications adapted for judo movements may be considered.**

475

476 The limitations of this study include (a) a standardized survey was adapted from prior research
477 whereby the use of alternate methods (e.g., focus groups) may have provided participants the
478 opportunity to answer questions in more depth; (b) the survey used was restricted in length
479 which led to some questions providing somewhat superficial responses, however, follow up
480 questions may have been beneficial; and (c) the majority of judokas and S&C coaches were
481 predominantly from one geographical location (Brazil), making it challenging to undertake a
482 deeper analysis across a wider demographic due to unbalanced samples. However, given that
483 this is the first study of this topic area to be conducted in judo, a broad basis of information

484 must be initially provided for future research to investigate interesting and contemporary areas
485 in more depth.

486

487 This study provides needed evidence on the contemporary S&C practices of judokas and S&C
488 coaches. Exercises such as deadlifts (including variations) for strength, weightlifting (including
489 derivatives) for speed and power, and judo-specific movements for agility and fitness were
490 commonly prescribed. Judokas and S&C coaches reported S&C to be highly important for the
491 physical preparation of judokas, reducing the occurrence of injuries, and optimizing
492 performance in judo competitions. The most reported issues and improvements were related to
493 periodization, such as balancing S&C around judo practice and competition schedules. Judokas
494 and S&C coaches reported they would like to see a greater emphasis on judo-specific S&C in
495 the future. These findings may support further research and the production of education and
496 qualification resources concerning effective S&C practices in judo.

497

498 **Practical Applications**

499 The information included in this study is valuable for those pursuing or currently employing
500 S&C practices in judo. Especially for judokas and S&C coaches to align and explain their
501 practices with other experienced practitioners from different countries and standards.
502 Furthermore, may benefit the wider support team (e.g., sports psychologists, sports therapists,
503 physiotherapists) given the growing inter- and transdisciplinary nature of sports.

504

505 Judokas and S&C coaches should continue to seek S&C information from viable sources (e.g.,
506 S&C coaches, research articles) and undertake relevant education and qualifications which may
507 enhance the effectiveness of S&C programs. This education should focus on key areas outlined
508 in this study, such as the development of strength, speed, power, agility, injury reduction, and
509 judo-specific fitness. Furthermore, with judo evolving from a physical preparation and
510 technology integration standpoint, those delivering S&C should stay abreast of such
511 developments, which may provide competitive advantages.

512

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515

516

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736 **Appendix**

737

738 **Judoka Survey**

739

740 ▪ Refers to questions with multiple-choice answers

741 • Refers to questions with single-choice answers

742

743 A) Informed Consent

744

745 • Agree

746 • Disagree

747

748 B) Background Information

749

750 Q1. Sex?

751 • Male

752 • Female

753 • Prefer not to say

754

755 Q2. Age? (must be over 18 years old)

756

757 Q3. Number of years' experience as a judoka?

758

759 Q4. What is the highest level of competition that you have competed in judo?

760 • International

761 • National

762 • Regional

763 • State

764 • Municipal

765 • Other

766

767 Q5. Which country are you currently based?

768

769 C) Education, Qualifications, and Prescription

770

771 Q6. What is your highest level of education?

- 772 • Secondary School
- 773 • Higher Diploma/Associate Degree
- 774 • Bachelor's Degree
- 775 • Master's degree
- 776 • Doctor of Philosophy (Ph.D.)
- 777 • Other

778

779 Q7. What was the subject area of your highest level of education?

780

781 Q8. Do you possess a strength and conditioning qualification with any of the below
782 organizations or any other related fitness qualification?

- 783 ▪ Australian Strength and Conditioning Association (ASCA)
- 784 ▪ National Strength and Conditioning Association (NSCA)
- 785 ▪ Collegiate Strength and Conditioning Coaches Association (CSCCa)
- 786 ▪ United Kingdom Strength and Conditioning Association (UKSCA)
- 787 ▪ None
- 788 ▪ Other

789

790 Q9. What is your highest level of judo qualification?

- 791 • Black Belt 1st dan
- 792 • Black Belt 2nd dan
- 793 • Black Belt 3rd dan
- 794 • Black Belt 4th dan
- 795 • Black Belt 5th dan
- 796 • Coral Belt 6th dan
- 797 • Coral Belt 7th dan
- 798 • Coral Belt 8th dan
- 799 • None
- 800 • Other

801

802 Q10. How often do you obtain strength and conditioning information from the following
803 sources?

	1 = Never	2 = Rarely	3 = Sometimes	4 = Commonly	5 = Always
Judo Coaches					
Judokas					
Strength and Conditioning Coaches					
Sports Therapists					
Physiotherapists					
Coaching Courses					
Research Articles					
Social Media					
Books and Magazines					
Other					

804

805 Q11. Who is mainly responsible for prescribing strength and conditioning exercises for you?

- 806 • Manager
- 807 • Head Coach
- 808 • Assistant Coach
- 809 • Independently (Yourself)
- 810 • Trainer
- 811 • Strength and Conditioning Coach
- 812 • Sports Therapist
- 813 • Physiotherapist
- 814 • Other: _____

815

816 D) Views on Strength and Conditioning

817

818 Q12. How important is strength and conditioning for the following components?

	1 = Not Important	2 = Slightly Important	3 = Moderately Important	4 = Important	5 = Very Important

Uchi-Komi (repetitive technical training)					
Nage-Komi (repetitive throwing training)					
Randori (combat or fight practice)					
Transition to groundwork					
Grip training					
Osae-Waza training (hold-down training)					
Judo-Specific Fitness					
Overall Judo Performance					

819

820 Q13. How important is strength and conditioning for the following components?

	1 = Not Important	2 = Slightly Important	3 = Moderately Important	4 = Important	5 = Very Important
Strength					
Speed and Power					
Injury Reduction					
Injury Rehabilitation/ Return to Competition					

821

822 Q14. How effective is your current strength and conditioning program for your judo
823 performance?

- 824 • 1 = Not Effective
- 825 • 2 = Slightly Effective
- 826 • 3 = Moderately Effective
- 827 • 4 = Effective
- 828 • 5 = Very Effective

829

830 Q15. Please explain why?

831

832 Q16. Please share your personal views on strength and conditioning for judo?

833

834 E) Exercise Selection

835

836 Q17. Name up to '**THREE**' strength and conditioning exercises **in order** of importance, you
837 consider most important for **STRENGTH DEVELOPMENT**?

838 1.

839 2.

840 3.

841

842 Q17.1 Explain why you have listed the '**FIRST**' exercise most important?

843

844 Q18. Name up to '**THREE**' strength and conditioning exercises **in order** of importance, you
845 consider most important for **SPEED AND POWER DEVELOPMENT**?

846 1.

847 2.

848 3.

849

850 Q18.1 Explain why you have listed the '**FIRST**' exercise most important?

851

852 Q19. Name up to '**THREE**' strength and conditioning exercises **in order** of importance, you
853 consider most important for **AGILITY**?

854 1.

855 2.

856 3.

857

858 Q19.1 Explain why you have listed the '**FIRST**' exercise most important?

859

860 Q20. Name up to '**THREE**' strength and conditioning exercises **in order** of importance, you
861 consider most important for reducing **JUDO-RELATED INJURIES**?

862 1.

863 2.

864 3.

865

866 Q20.1 Explain why you have listed the **'FIRST'** exercise most important?

867

868 Q21. Name up to **'THREE'** strength and conditioning exercises **in order** of importance, you
869 consider most important for reducing **JUDO-SPECIFIC FITNESS?**

870 1.

871 2.

872 3.

873

874 Q21.1 Explain why you have listed the **'FIRST'** exercise most important?

875

876 F) Issues and Improvements

877

878 Q22. Explain the biggest issues you face when implementing strength and conditioning?

879

880 Q23. Explain any disadvantages associated with strength and conditioning?

881

882 Q24. Given unlimited time and resources, how would you change or improve your current
883 strength and conditioning provisions?

884

885 Q25. What developments or advancements do you believe will be integrated into judo-specific
886 strength and conditioning in the future?

887

888

889 **Strength and Conditioning Coach Survey**

890

891 ▪ Refers to questions with multiple-choice answers

892 • Refers to questions with single-choice answers

893

894 A) Informed Consent

895

896 • Agree

897 • Disagree

898

899 B) Background Information

900

901 Q1. Sex?

902 • Male

903 • Female

904 • Prefer not to say

905

906 Q2. Age? (must be over 18 years old)

907

908 Q3. Number of years' experience as a judo strength and conditioning coach?

909

910 Q4. What is the highest level of athlete you have worked with in judo?

911 • International

912 • National

913 • Regional

914 • State

915 • Municipal

916 • Other

917

918 Q5. Which country are you currently based?

919

920 C) Education, Qualifications, and Prescription

921

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925 • Bachelor's Degree

926 • Master's degree

927 • Doctor of Philosophy (Ph.D.)

928 • Other

929

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931

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933 organizations or any other related fitness qualification?

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- 936 ▪ Collegiate Strength and Conditioning Coaches Association (CSCCa)
- 937 ▪ United Kingdom Strength and Conditioning Association (UKSCA)
- 938 ▪ None
- 939 ▪ Other

940

941 Q9. What is your highest level of judo qualification?

- 942 • Black Belt 1st dan
- 943 • Black Belt 2nd dan
- 944 • Black Belt 3rd dan
- 945 • Black Belt 4th dan
- 946 • Black Belt 5th dan
- 947 • Coral Belt 6th dan
- 948 • Coral Belt 7th dan
- 949 • Coral Belt 8th dan
- 950 • None
- 951 • Other

952

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954 sources?

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Judokas					
Strength and Conditioning Coaches					
Sports Therapists					

Physiotherapists					
Coaching Courses					
Research Articles					
Social Media					
Books and Magazines					
Other					

955

956 Q11. Which other personnel besides strength and conditioning coaches do you see prescribing
957 strength and conditioning exercises for judokas?

- 958 • Manager
- 959 • Head Coach
- 960 • Assistant Coach
- 961 • Independently (Yourself)
- 962 • Trainer
- 963 • Strength and Conditioning Coach
- 964 • Sports Therapist
- 965 • Physiotherapist
- 966 • Other: _____

967

968 D) Views on Strength and Conditioning

969

970 Q12. How important is strength and conditioning for the following components?

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Nage-Komi (repetitive throwing training)					
Randori (combat or fight practice)					
Transition to groundwork					

Grip training					
Osae-Waza training (hold-down training)					
Judo-Specific Fitness					
Overall Judo Performance					

971

972 Q13. How important is strength and conditioning for the following components?

	1 = Not Important	2 = Slightly Important	3 = Moderately Important	4 = Important	5 = Very Important
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Speed and Power					
Injury Reduction					
Injury Rehabilitation/ Return to Competition					

973

974 Q14. How effective is your current strength and conditioning program for improving judo
975 performance?

- 976 • 1 = Not Effective
- 977 • 2 = Slightly Effective
- 978 • 3 = Moderately Effective
- 979 • 4 = Effective
- 980 • 5 = Very Effective

981

982 Q15. Please explain why?

983

984 Q16. Please share your personal views on strength and conditioning for judo?

985

986 E) Exercise Selection

987

988 Q17. Name up to 'THREE' strength and conditioning exercises **in order** of importance, you
989 consider most important for **STRENGTH DEVELOPMENT**?

- 990 1.
991 2.
992 3.
993
994 Q17.1 Explain why you have listed the **'FIRST'** exercise most important?
995
996 Q18. Name up to **'THREE'** strength and conditioning exercises **in order** of importance, you
997 consider most important for **SPEED AND POWER DEVELOPMENT?**
998 1.
999 2.
1000 3.
1001
1002 Q18.1 Explain why you have listed the **'FIRST'** exercise most important?
1003
1004 Q19. Name up to **'THREE'** strength and conditioning exercises **in order** of importance, you
1005 consider most important for **AGILITY?**
1006 1.
1007 2.
1008 3.
1009
1010 Q19.1 Explain why you have listed the **'FIRST'** exercise most important?
1011
1012 Q20. Name up to **'THREE'** strength and conditioning exercises **in order** of importance, you
1013 consider most important for reducing **JUDO-RELATED INJURIES?**
1014 1.
1015 2.
1016 3.
1017
1018 Q20.1 Explain why you have listed the **'FIRST'** exercise most important?
1019
1020 Q21. Name up to **'THREE'** strength and conditioning exercises **in order** of importance, you
1021 consider most important for reducing **JUDO-SPECIFIC FITNESS?**
1022 1.

1023 2.

1024 3.

1025

1026 Q21.1 Explain why you have listed the **'FIRST'** exercise most important?

1027

1028 F) Issues and Improvements

1029

1030 Q22. Explain the biggest issues you face when implementing strength and conditioning?

1031

1032 Q23. Explain any disadvantages associated with strength and conditioning?

1033

1034 Q24. Given unlimited time and resources, how would you change or improve your current
1035 strength and conditioning provisions?

1036

1037 Q25. What developments or advancements do you believe will be integrated into judo-specific
1038 strength and conditioning in the future?

1039

1040