

“Making weight” among Dutch elite competitive judo athletes

The relation between “making weight” and psychological complaints, diseases, injuries and performance among Dutch elite competitive judo athletes.

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Abstract

Introduction: The aim of the present study was to investigate the relation between making weight and psychological complaints, diseases, injuries and performance among Dutch competitive elite judo athletes in order to achieve “healthy” judo practice. In addition differences between Dutch elite and non-elite judo athletes regarding their weight loss behavior were determined. **Methods:** A previously validated questionnaire: “Making weight among Judo athletes” (GMJ) was used to measure different aspects of making weight, the prevalence of diseases and injuries and the performance (objective and subjective) of judo athletes. Psychological complaints were measured with the SCL-90. **Results:** Significant differences were found between elite and non-elite judo athletes regarding their weight loss behavior, with elite judo athletes having a more aggressive and harmful weight loss behavior. For elite judo athletes, significant positive relations were found between making weight and psychological complaints (depression, psychosomatic complaints, anxiety and a higher psychological dysfunction), acute injuries and diseases (e.g. diarrhea). Significant negative relations were found between making weight and the objective (e.g. absolute number of medals) and subjective performance (satisfaction towards judo performance). **Conclusion:** Elite judo athletes showed a more aggressive and harmful weight loss behavior than non-elite judo athletes. Making weight seems to be related with psychological complaints, acute injuries and diseases (e.g. diarrhea). In addition, aggressive weight making and restricting carbohydrates seems to negatively influence the performance of elite judo athletes.

Samenvatting

Introductie: Het doel van de huidige studie was het onderzoeken van de relatie tussen gewicht maken en psychologische klachten, ziekten, blessures en prestaties onder Nederlandse top wedstrijd judoka's om een gezonde beoefening van judo te bereiken. Ook werd het verschil tussen het gedrag van Nederlandse top judoka's en recreatieve judoka's met betrekking tot hun gewichtsverlies bepaald. **Methoden:** Een eerder gevalideerde vragenlijst: “Gewicht Maken onder Judoka's” is gebruikt om verschillende aspecten van gewicht maken, het voorkomen van ziekten en blessures, en de prestatie (objectief en subjectief) van judo atleten te meten. Psychologische klachten zijn gemeten met de SCL-90. **Resultaten:** Significante verschillen zijn gevonden tussen top judoka's en recreatieve judoka's in hun gedrag met betrekking tot gewichtsverlies, waarbij het gedrag van top judoka's met betrekking tot gewichtsverlies agressiever en schadelijker was. Voor topjudoka's zijn er significante positieve relaties gevonden tussen gewicht maken en psychologische klachten (depressie, psychosomatische klachten, angst en een hoger psychologisch disfunctioneren), acute blessures en ziekten (bv. diarree). Significante negatieve relaties zijn gevonden tussen gewicht maken en de objectieve (bv. absoluut aantal medailles) en subjectieve prestatie (tevredenheid t.o.v. judo prestatie). **Conclusie:** Topjudoka's lieten een agressiever en schadelijker gedrag zien met betrekking tot gewichtsverlies dan recreatieve judoka's. Gewicht maken lijkt gerelateerd te zijn aan psychologische klachten, acute blessures en ziekten (bv. diarree). Ook lijkt agressief gewicht maken en het beperken van koolhydraten de prestatie van top judoka's negatief te beïnvloeden.

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1. Introduction

“Without a doubt, the leading theme in my career has been the battle against the scales”.

Gella Vandecaveye - former Flemish Judo World Champion.

Gella Vandecaveye, has won a total of eleven European medals, including seven Gold, two Silver and two Bronze. She was the number one in the world for many years and was four times elected judoka of the year in all categories (Vanmeensel, 2009). “The life of an athlete is a hard life, intense, with unforgettable experiences, highs and lows” as expressed by Gella’s coach, Eddy Vinckier (Vanmeensel, 2009).

The battle against the scales is a common phenomenon in judo. Especially among elite judo athletes, where it is normal to optimize one’s body weight prior to a major competitive season or major tournament (Pettersen, Ekström & Berg, 2012). Judo is an Olympic sport in which judo athletes are classified into weight classes. Other weight class related combat sports include boxing, wrestling and karate (Artioli et al., 2010; Pettersen et al., 2012). The purpose of the weight classification is to minimize differences in strength and weight to ensure a fair competition (Artioli et al., 2010). However, judo athletes often choose for a lower weight class than their usual weight to have advantages against weaker and smaller opponents (Horswill, 2009). To achieve this “ideal” competitive weight, judo athletes often have to lose weight prior to competitions. This phenomenon is also known as “making weight” (Langan-Evans, Close & Morton, 2011). Unfortunately, weight regulation practices can be harmful to both the psychological and physical health as well as the performance of elite judo athletes (Degoutte et al., 2006; Filaire, Maso, Degoutte, Jouanel & Lac, 2001; Franchini, Brito & Artioli, 2012).

1.1 Weight loss behavior among judo athletes

Weight loss is highly prevalent among judo athletes. Several studies have shown that the prevalence of weight loss before competitions among judo athletes is between 63% and 89% (Artioli et al., 2010; Brito et al., 2012; Horswill, 2009; Kinningham & Gornenflo, 2001; Kordi, Ziaee, Rostami & Wallace, 2011). Furthermore, research showed that judo athletes usually lose between the 2.5% and 5% of their body weight before competitions (Alderman, Landers, Carlson & Scott, 2004; Artioli et al., 2010; Kordi et al., 2011). Artioli et al. (2010) found that judo athletes cut their weight between the 3 and 5 times per season. Weight loss among judo athletes is achieved by using a wide variety of methods which are usually aimed at dehydration (loss of body fluid) and/or reducing energy intake.

Examples of dehydration methods are exercising in synthetic training suits, restricting fluid intake and the use of saunas to increase perspiration (Alderman et al., 2004; Artioli et al., 2010; Brito et al., 2012; Langan-Evans et al., 2011; Oppliger, Steen & Scott, 2003; Steen & Brownell, 1990). More aggressive methods are the use of laxatives, diet pills, diuretics or vomiting (Artioli et al., 2010). Methods aimed at reducing energy intake include fasting, and reducing carbohydrate intake and/or fat intake (Artioli et al., 2010; Brito et al., 2012; Langan-Evans et al., 2011; Oppliger et al., 2003). Finally, a frequently used method to lose weight is increasing energy expenditure through exercise (Bruto et al., 2012, Filaire, Larue & Rouveix, 2010). The level of aggressiveness of weight loss behavior might be influenced by competitive level (e.g. elite or non-elite judo athletes). Artioli et al. (2010) argued that more aggressive weight management strategies are used at higher competition levels in judo athletes. An explanation for this might be that elite judo athletes are more motivated to optimize performance when comparing them with non-elite judo athletes (Pettersen et al, 2012).

1.2 Consequences of making weight

In the following paragraphs, the possible consequences of making weight on the psychological and physical health of the elite judo athletes as well as on their performance will be discussed in more detail.

1.2.1 Psychological consequences of making weight

Researchers have investigated the effect of weight loss on the mental state of athletes in weight-class related sports. Rouveix, Bouget, Pannafieux, Champely & Filaire (2007) found increased tension, fatigue, anger, confusion and anxiety among judo athletes who were participating in severe weight management procedures compared to judo athletes who were not losing weight. Likewise, Filaire et al. (2001) found that the mood states confusion, anger, fatigue and tension were significantly higher among judo athletes after weight loss compared to judo athletes who had not lost weight. All studies mentioned above used the POMS questionnaire which is mainly focused on measuring changes in mood states (Mc Nair, Lorr & Droppleman, 1971). Unfortunately, scarce literature is available about the effect of making weight on the overall psychological state of judo athletes. Up to present no questionnaire has been used that provides a broader view of the psychological consequences of weight loss.

Investigation in the relation between making weight and a broader range of psychological complaints might contribute to a better understanding of the complex relation between making weight and psychological consequences.

1.2.2 Physical consequences

Besides psychological consequences, previous research has shown that making weight might have negative consequences on the physical health of the athletes. For example, it has been found that the loss of body weight may have serious detrimental effects on the immune system (Kowatori et al., 2001). During intensive training and major competitions, immunosuppression occurs, and good nutrition is of great importance in preventing such. Judo athletes who restrict their energy intake may not get enough nutrients to prevent immunosuppression, and the combination of intensive training and a lack of important nutrients might lead to the development of chronic immunosuppression. Chronic immunosuppression in turn may result in a decreased resistance to infections and diseases (Chandra, 1991; Kowatori et al., 2000; Pedersen & Bruunsgaard, 1995; Pyne, 1994; Shephard, Thomas & Shek, 1991; Tsai, Chous, Chang & Fang, 2011). Furthermore, results from Alderman et al. (2004), illustrated symptoms like dizziness, headache, nausea, nosebleeds, hot flashes, fever, disorientation and an increased heart rate among wrestlers who engaged in rapid and repeated weight loss procedures.

In addition, several researchers found a relation between weight loss and the risk of injuries. For example Tsai et al. (2011), who investigated the relation between making weight and injuries among judo athletes, argued that judo athletes have an increased risk of developing injuries. Green, Petrou, Fogarty-Hover, and Rolf (2007) support these results and found that the risk of injuries during competitions is increased in those athletes who lose more than 5% of their body weight. However, results about the effect of making weight on the development of injuries are somewhat controversial. For example, Prouteau, Pelle, Collomp, Benhamou & Courteix (2006) argued that “making weight” does not influence bone density of judo athletes and therefore might not influence the risk of injuries.

1.2.3 Performance

Despite the negative effects of making weight on the psychological and physical health, many judo athletes choose to compete in a lower weight class than their normal weight. Especially among elite judo athletes, performance related motives might be an explanation for this.

However, it is still unclear whether reduction to a lower-than-normal body weight has a positive or negative effect on performance (Horswill, 2009). Studies that have examined the consequence of weight loss on performance in combat sports show conflicting results. For example, Degoutte et al, (2006), reported that the combination of intensive exercise and energy restriction before a competition adversely affected the performance of the judo athletes. The study of Fogelholm, Koskinen, Laakso, Rankinen & Ruokonen (1993) showed quite similar results: judo athletes who engaged in gradual weight loss procedures had a higher performance capacity than judo athletes who lost weight rapidly. In contrast, other studies showed that rapid weight loss did not affect judo-related performance (Artioli et al., 2010; Koral & Dosseville, 2009; Marttinen, Judelson, Wiersma & Coburn, 2011).

To summarize, making weight has been shown to have some serious negative effects on the psychological and physical state as well as on the performance of elite judo athletes. However, many results from studies about the relation between making weight and its consequences are still conflicting and give an unclear view. Moreover, although there are some results available about making weight in judo, literature about making weight among Dutch elite competitive judo athletes is absent. In the Netherlands, judo is a very popular sport which is practiced at both national and international level. In order to promote a healthy sport practice among Dutch elite competitive judo athletes, it is of great importance to get a better insight in the relation between making weight and its possible consequences.

1.3 The present research

The aim of the present research is to achieve “healthy” judo practice among Dutch elite competitive judo athletes. “Healthy” implies that competitive judo is practiced with the least harmful weight loss methods and the least negative psychological, physical and performance-related consequences for the Dutch elite competitive judo athletes. To give an idea of what can be considered as “healthy” weight loss, the Dutch Olympic Committee (NOC*NSF) has published fact sheets with guidelines for responsible weight loss. They state that a maximum weight loss between the 0.5 and 1.0 kilograms per week is the most optimal to maintain health and performance of an athlete. In addition, they recommend athletes not to exceed a maximum weight of 3% above their competition weight during competitions seasons. A weight fluctuation over 3% during a competition season enhances the risk of developing

disrupted eating patterns. However, in order to achieve healthy sports practice it is first of all important to gain knowledge about the relation between “making weight” and its possible consequences. More clarification on the relation between making weight and its possible consequences can provide useful information for the elite judo athletes, the Dutch judo federation and their accompanying sports medical framework (e.g. sports doctors, sports psychologists and sport dieticians) and sports technical framework (coaches). With this information, judo athletes and their direct environment (coaches, parents etc.) will become more aware of the consequences of making weight, which in return may encourage healthy judo practice.

In this perspective, the main research question is formulated as follows:

Is there a relation between “making weight” and the following parameters among Dutch elite competitive judo athletes?

1. Psychological complaints
2. Diseases
3. Injuries
4. Performance

Before investigating the relation between making weight and the above mentioned parameters, the difference between elite and non-elite judo athletes regarding their weight loss behavior will be determined. By comparing elite judo athletes with non-elite judo athletes it will be possible to get a clear view of the severity of the weight loss behavior among elite judo athletes.

In this study, psychological complaints among Dutch elite competitive judo athletes will be measured with the SCL-90, a questionnaire which measures the current symptom status of the participants. Furthermore, the prevalence of the following diseases will be investigated: having a cold, a sore throat, the flu, vomiting, diarrhea, dry mouth, muscle cramps and loss of physical condition. In addition, females will be asked to indicate to which extent they experience menstrual complaints (irregular or absent menstrual periods). Subsequently, elite

judo athletes will be asked to describe all the injuries they have had past year. Finally, to investigate whether there is a relationship between making weight and performance, elite judo athletes will be asked to report the number of medals they have won in the past year and the amount of competitions they have participated in. The performance ratio (the number of medals divided by the number of competitions in the previous year) will be used as a measure for performance. Also, as a more subjective performance measure, the satisfaction of the elite judo athletes towards their own performance will be investigated.

1.4 Hypotheses

First of all, it is assumed that differences will be reported between elite and non-elite judo athletes regarding their weight loss behavior. More specific, it is hypothesized that the weight loss behavior of Dutch elite competitive judo athletes is more aggressive than the weight loss behavior of Dutch non-elite competitive judo athletes. This is in accordance with the earlier mentioned results of Artioli et al. (2010), who argued that more aggressive weight management strategies are used among judo athletes in higher competition levels.

When focusing on elite judo athletes only, it is hypothesized that making weight is positively related to psychological complaints. Previous research from Koral & Dosseville (2009) showed that the mood states confusion and tension were increased among elite judo athletes after weight loss before competitions. Therefore, in this study it is expected that elite judo athletes who are making weight will experience psychological complaints more often than elite judo athletes who are not making weight. Likewise, it is assumed that positive relations will be found between making weight on the one hand and the prevalence of both diseases as well as injuries on the other hand, since there are several results in literature which support a high risk for infections and injuries due to losing weight (Chandra, 1991; Green et al., 2007; Kowatori et al., 2000; Leydon & Wall, 2002; Pedersen & Bruunsgaard, 1995; Prouteau et al., 2006; Pyne, 1994; Shephard, 1991; Tsai et al., 2011). With respect to the relation between making weight and performance, previous studies have found that intensive exercise in combination with a negative energy balance is likely to cause a reduction in lean body mass and may therefore impair strength and performance (Degoutte et al., 2006; Fogelholm et al. 1993; Koral & Dosseville, 2009).

Based on these results, a negative relation between making weight and the performance (both objective and subjective) of judo athletes is expected.

2. Methods

2.1 Participants

Three hundred twenty eight Dutch competitive judo athletes (112 females and 216 males) between the ages of 12 and 55 years (mean age=17.76, SD=5.98) participated in this study. Table 1 represents the main characteristics of the participants.

The participants in the present study were divided into the following groups: A) Dutch elite (n=122) and B) Dutch non-elite competitive judo athletes (n=206). Group A consisted of Dutch competitive judo athletes who were placed on the national list of the Dutch judo federation at the moment of research. Additionally, this group consisted of Dutch competitive judo athletes who had been placed in the top four of the Dutch Championships in the year preceding the research. Group B consisted of Dutch competitive judo athletes who were not placed on the national list of the Dutch judo federation and/or in the top four of the Dutch Championships. Group B (non-elite judo athletes) was included as a reference group. When comparing elite judo athletes with non-elite judo athletes it is possible to get a clear view of the severity of making weight among elite judo athletes.

To be included, judo athletes had to be twelve years or older and had to have a minimum of two years of judo competition experience. Nineteen participants were excluded because they did not meet the age-criterion of twelve years or older. Additionally, 13 participants were excluded because they had less than 2 years competition experience. Furthermore, 6 participants were excluded because they were not participating in competitions anymore. This decision was based on the idea that judo athletes out of competition would not be able to fill out the questionnaire in the same line of thought as when they actively participated in competitions. Also, four participants were excluded because they responded to answers about weight loss with information about weight loss in the past instead of currently weight loss. Ten participants were excluded because they did not fill out the questionnaire properly. Questionnaires were considered as not representative when the judo athletes did not fill out the questionnaire seriously (e.g. loud talking, discussing with others and laughing) or their parents filled out the questionnaire. This criterion was also used when, during the input of the data, it became clear that the questionnaire was not filled out seriously (e.g. giving the same responses to all questions and leaving many questions unanswered). Finally, 8 heavy weights were excluded because judo athletes in this weight category do not necessarily have to cut weight

before competitions. However, to provide a clear and comprehensive view of all the participants, the 8 heavyweights were included in the descriptive analysis. For an overview of the excluded participants and the exclusion criteria see table 2 in appendix 7.

Table 1. Main characteristics of the participants (level, gender, age, BMI and age began practicing judo).

Level (elite/ non-elite)	Gender (male/ female)	n (%)	Age(yr)			BMI			Age began Practicing Judo(yr)	
			M	SD	Md	M	SD	Md	M	SD
Elite	Females	63 (52%)	18.13	3.63	18.00	21.72	2.65	21.65	6.02	1.63
	Males	59 (48%)	19.47	4.24	18.00	23.59	4.18	22.84	5.84	1.46
Total	**	122	18.78	3.97	18.00**	22.63	3.59	21.99**	5.93	1.54
Non-elite	Females	49 (24%)	15.69	3.52	15.00	20.20	2.70	19.89	6.46	1.60
	Males	157 (76%)	17.62	7.53	15.00	21.11	3.64	20.35	6.22	1.94
Total	**	206	17.16	6.84	15.00**	20.90	3.46	20.31**	6.28	1.86
Total		328	17.76	5.98		21.55	3.60		6.15	1.76

** $p < .01$

Note: M=Mean score, Md=Median score

Note: A Chi-square analysis showed significant differences between elite and non-elite judo athletes in gender, $\chi^2(1, N = 320) = 24.567, p < .001, phi = -.28$. Additionally, a Mann-Whitney U test revealed a significant difference in age for elite (Md=18.00, n=117) and non-elite judo athletes (Md=15, n=203), $U=7215.500, z=-5.871, p=.000$. Another Mann-Whitney U test revealed a significant difference in BMI for elite (Md=21.99, n=116) and non-elite judo athletes (Md=20.31, n=316), $U=8371.000, z=-4.125, p=.000$.

2.2 Cross correlation research

In this research a cross-sectional design was used to explore the relation between “making weight” and its consequences on the health and performance of Dutch elite competitive judo athletes. Questionnaires were collected among both Dutch non-elite and elite competitive judo athletes. The judo athletes were asked to fill out two questionnaires before or after their judo training.

2.3 Assessment

In the present study, the following questionnaires were included.

2.3.1 Questionnaire: “Making Weight Among Judo athletes” (in Dutch: “Gewicht Maken Onder Judoka’s, GMJ)

The first questionnaire used in this research, “Making Weight Among Judo athletes”, was previously validated in a sample of Dutch competitive judo athletes (n=322) who were recruited from Dutch judo clubs connected to the Dutch judo federation (Judo Bond Nederland). The questionnaire “Making Weight Among Judo Athletes” consists of six sections which measure different aspects of “making weight”, the prevalence of diseases and injuries and performance among competitive judo athletes. The complete questionnaire is included in appendix 1.

In the first section “*general information*” judo athletes had to answer questions regarding their age, gender, length, weight, percentage of body fat, age at which they started with judo and judo competitions, number of training hours and their previous and following competition. In addition questions regarding performance were included. Specifically, judo athletes were asked to answer questions about: the number of competitions in which they had participated in the past year and the total number of medals they had won in the past year.

The second section “*weight and diet history*” is mainly based on the Rapid Weight Loss Questionnaire (RWLQ) of Artioli et al. (2010). The RWLQ of Artioli et al. (2010) contains eight questions which are individually scored and together form a total score which represents the extent to which a judo athlete is making weight. For an overview of the questions and the scores assigned to each individual question in the RWLQ of Arteoli et al. (2010) see appendix 2. In this research the same calculation is used: the questions 19, 20, 21, 22, 23, 26, 28 and 30 of the GMJ (see appendix 1) are individually scored and together form a total score or making weight index score (“MW index score”) which represents the extent to which the judo athlete is “making weight”. The higher the total score obtained by a judo athlete, the more aggressive and harmful his/her weight management behavior is. In the end judo athletes had to answer several questions about: the amount of weight lost in the last week before the competition, the average weight on competition day prior to the first fight and the weight between the last and next competition.

In the third section, *statements*, judo athletes were asked to answer statements about their attitude towards: their own performance and the effect of losing weight on their performance. The judo athletes were asked to indicate on a 5-point Likert-scale to what extent they agreed with the statements (1= Strongly disagree, 2= Slightly disagree, 3= Neither agree nor disagree, 4= Slightly agree, 5= Strongly agree). A sixth scale (6= not applicable) is added for judo athletes who indicated that they had never participated in weight loss procedures and were not able to answer statements in which experience with making weight was necessary.

In the fourth section, judo athletes were asked to give their opinion about statements regarding a recent adjustment which has been made in the regulations of the weigh-in process of the International Judo Federation (IJF). However, this section was not used in the present research because this section is not applicable to the research questions of the present study.

The fifth section serves to evaluate the physical health of judo athletes. Judo athletes had to answer questions about the number and kind of injuries they had in the past year. In addition, judo athletes were asked to indicate on a 5-point Likert scale to what extent they experienced health complaints (1= Never, 2=Rarely, 3= Sometimes, 4= Often, 5=Always). The following symptoms and diseases were evaluated: having a cold, a sore throat, the flu, diarrhea, dry mouth, muscle cramps, vomiting and loss of condition. In addition females were asked to indicate to which extent they experienced irregular or absent menstrual periods.

The last and sixth section, *menstruation*, is only meant for female judo athletes who already had their first menstrual period. This section contains questions about specific details of the menstruation (the regularity of the menstrual period, the absence of menstruation, the number of menstruation periods in the last three months, the use of oral contraceptives and the occurrence of pregnancy or breastfeeding).

This questionnaire (GMJ) was earlier considered as valid for content (evaluation by 9 experts). In addition, the construct validity (convergent, divergent and discriminant validity) was considered as sufficient. Furthermore, Cronbach's alpha was 0.68 and a good to perfect test-retest reliability was established (Petter, 2013). In conclusion, the survey tool which is used in this present study has sufficient validity and reliability to measure "making weight" among judo athletes.

2.3.2 Symptom Check List 90 (SCL-90).

The second questionnaire, the Symptom Check List 90 (SCL-90), was used as a self-report measure of psychopathology. The SCL-90 is suitable for participants of twelve years and older. This questionnaire measures the current symptom status of respondents and consists of 90 descriptions of psychological complaints. The judo athletes were asked to indicate on a 5-point Likert scale to what extent they suffered from each complaint in the past week (1=Never, 2=Rarely, 3=Occasionally, 4=Very frequently, 5= Always). The SCL-90 consists of the following nine symptom dimensions: Anxiety, Agoraphobia, Depression, Psychosomatic complaints, Insufficiency of thinking and acting, Distrust and Interpersonal sensitivity, Hostility and Trouble with Sleeping. In addition, the Psycho neuroticism scale represents the total score of all the items. The Psycho neuroticism scale indicates the overall level of psychological dysfunction (Cronbach's $\alpha=0.95$) (Arrindell et al., 2003). For a description of the nine symptom dimensions see table 3 in appendix 7.

2.4 Procedure

The judo athletes were recruited from judo clubs in the Netherlands which are part of the Dutch judo federation (Judo Bond Nederland). The federation provided contact information of all their connected judo clubs and sports clubs (in which judo and other combat sports were practiced) in the Netherlands ($n=658$). In addition they posted a message on their website to inform all their associated judo and sports clubs about this current study. In total 239 clubs were approached by email and asked whether they were interested to contribute in this research. Fifty six clubs responded to the email. Additionally, 6 clubs offered to participate in this research in reaction to the message on the site (=spontaneous reactions). An overview of the clubs who eventually participated in this research ($n=17$) is illustrated in table 4.

When a club agreed to participate in this research, coaches were asked to approach potential suitable competitive judo athletes of their club and ask them if they were willing to participate in this research. When there were enough suitable participants ($n > 6$), a standard procedure was carried out. First, an introduction letter and an informed consent were emailed to the club. The club was asked to distribute this introduction letter among all judo athletes and to distribute the informed consent among all the parent(s) or legal guardian(s) of the judo athletes under the 18 years (see appendix 3 for the introduction letter and appendix 4 for the informed consent parents/guardians). Judo athletes under the 18 years were asked to bring the

informed consent on the day of the survey, signed by their parent(s) or legal guardian(s). The coach (or another contact of the club) was contacted by telephone or mail to find a suitable date and time for filling out the questionnaires. In addition coaches were asked if it was possible to perform the research in a separate room or meeting room to provide a quiet working environment. When this was not possible, the questionnaires were completed in the judo gym. Two to three weeks before the research (2 or 3 weeks), judo athletes were informed about the date and time of the research and were told that the research would take half an hour of their time. If the judo athlete agreed to participate in the research, he/she signed the informed consent (when 18 years or older) (see appendix 5) and then filled out the questionnaire. A judo athlete under the 18 years had to hand in the informed consent signed by their parents or the legal guardian before they were allowed to fill out the questionnaire.

Most judo athletes filled out the questionnaire after their training. However, sometimes two groups of judo athletes (e.g. youth and adults or females and males) trained at two different times in the same evening (early and late in the evening). In this case, one group filled out the questionnaire after their training (the early group) and the other group before their training (the late group). In this way it was possible to give a general introduction to both of the groups at the same time. In the general introduction, information about the research was given along with some remarks about filling out the questionnaire. Remarks were made about the anonymity of the participants. Anonymity was guaranteed for all the judo athletes who filled out the questionnaire. Furthermore, judo athletes were asked to fill out the questionnaire without communication with others. Coaches, parents and friends were asked not to interfere with the answering of the questionnaires. In addition, the judo athletes were instructed to raise their hand when something was unclear. In all procedures, one or two research assistants were present, usually accompanied with one or two main researchers (a sports physician and a sports psychologist). When a judo athlete completed the questionnaire he/she received the front page of the questionnaire on which contact information of the researchers was given. In addition they received an energy drink or muesli bar to thank them for participation in this research.

Table 4. Overview number of participants and mean age in years (Standard Deviation) for each judo club.

Judoclub	Date research	Female			Male			Total
		n	Age		n	Age		
			M	SD		M	SD	
1. Karel Gietelink Amstelveen	21-03-2013	0	0	0	12	34.67	12.28	
2. Top judo Nijmegen	13-05-2013	8	14.88	3.00	24	15.54	4.13	
3. Lu-Gia-Jen/JT Haaglanden	16-05-2013	9	15.22	4.21	15	18.47	7.09	
4. Judo Martijn Dijkman Groningen	24-05-2013	4	17.25	2.99	8	16.75	5.65	
5. Top judo Utrecht	30-05-2013	5	14.80	3.49	18	14.28	1.49	
6. Judo club Berlicum	03-06-2013	6	16.00	2.00	10	15.90	2.77	
7. Judo Groningen	04-06-2013	7	14.57	2.23	10	14.60	2.32	
8. Judo Bijsterbosch Heerde	06-06-2013	5	18.80	4.09	13	17.31	3.04	
9. Judo Haarlem	10-06-2013	16	18.69	4.36	32	18.03	6.84	
10. Judo Zaandam Hikari	13-06-2013	2	13.00	1.41	14	15.43	3.25	
11. Judo club THAG Geesteren	14-06-2013	0	0	0	7	15.29	2.22	
12. Mattekloppers Groningen	20-06-2013	0	0	0	1	25.00	0	
13. Judo club Helden	22-06-2013	1	24	0	8	17.25	4.59	
14. Team training elite judo athletes Papendal (seniors)	26-06-2013	18	21.33	2.54	21	22.76	4.01	
15. Team training elite judo athletes Nieuwegein (-18 females)	07-07-2013	23	16.39	1.70	0	0	0	
16. Team training elite judo athletes Nieuwegein (-18 males & seniors)	10-07-2013	0	0	0	18	17.56	1.58	
17. Eindhoven (-18 males and females)	20-08-2013	8	13.75	0.87	5	14.20	1.64	
Total		112	17.06	3.76	216	18.13	6.83	328

2.5 Statistical Analyses

In the present study, statistical analyses were made by using the Statistical Package for Social Sciences (SPSS-version 21). Descriptive statistics were used to summarize demographic variables and making weight characteristics of the Dutch competitive judo athletes. To provide a clear and comprehensive view of all the participants, heavyweights were included in the descriptive analysis. In all other analyses, heavy weights were excluded because they did not engage in weight loss procedures and including them would violate the data. A normality test (Shapiro-Wilk) was initially performed to examine the data distribution among important variables in this research: variables related to making weight, demographic variables, SCL-90 scales, variables related to the prevalence of diseases and injuries and several performance variables. The results of this analysis indicated a violation of the assumption of normality, except for the variable body mass index (BMI). Therefore, non-parametric tests or transformations of variables were used in parametric tests to analyze the data. Before performing further statistical analyses, the scale of the variable “weight loss methods” (question 30 of questionnaire GMJ, see appendix 1) was converted. More specific, judo athletes could indicate on a 5-point Likert- scale to what extent they used a specific method to lose weight (1=always, 2=sometimes, 3=almost never, 4=never, 5=not anymore). This scale was converted as follows: 0=never, 1=not anymore, 2=almost never, 3=sometimes, 4=always in order to create an ordinal level. The higher the score, the more often judo athletes (had) used the relevant method. Likewise, the variable “diseases” (question 39 of questionnaire GMJ, see appendix 1) was converted to: 0=not at all, 1=almost never, 2=sometimes, 3=often, 4=very often. Furthermore variables were created which represented the mean scores of the diseases. For an overview of all the eight diseases and the mean score variables, see table 6 in appendix 7. Finally, five variables were created with respect to injuries (question 38 of questionnaire GMJ, see appendix 1). For an overview of the five variables see table 7 in appendix 7.

2.5.1 Factor analysis

A factor analysis was performed by means of principal components method of extraction with Kaiser’s criterion (Eigenvalue over 1). The factor analysis was subjected to the 18 weight loss methods (see questions 30 of the questionnaire GMJ, appendix 1). The data were found to be suitable for factor analysis: the correlation matrices showed multiple correlations of $r \geq .3$, the Bartlett’s tests of sphericity was significant $p < .01$, and the Kaiser-Meyer-Olkin values

exceeded the recommended value of .6 (Kaiser, 1970; 1974 in Pallant, 2013). In addition, several reliability analyses were performed to determine internal consistency in Cronbach's alphas of the scales. The results of the factor analysis revealed four different classifications of weight loss methods: 1) Gradual weight loss; 2) Pathogenic weight loss practices; 3) Dehydration and training; 4) Rapid (dietary) weight loss. In table 5 (see appendix 7), the results of the factor analysis are illustrated.

2.5.2 Correlations

Spearman's rank correlations analyses were performed to investigate the relation between making weight and the following parameters among elite judo athletes: 1) psychological complaints, 2) diseases, 3) injuries and 4) performance. Different variables of making weight were used in this investigation: the making weight index score (the MW index score, i.e. the extent to which the judo athlete is "making weight"), the scores on separate items of the MW index score and the four scales representing classifications of weight loss methods.

2.5.3 Comparison of groups

2.5.3.1 Differences between elite and non-elite judo athletes regarding their weight loss behavior

At first, one way-analyses of covariance (ANCOVAs) were conducted to test whether elite judo athletes differed from non-elite judo athletes regarding their weight loss behavior. Gender, age and BMI were taken as covariates in these analyses (elite and non-elite athletes significantly differed on gender, $\chi^2(1, N = 320) = 24.567, p < .001, \phi = -.28$, age, $U=7215.500, z=-5.871, p=.000$ and BMI, $U=8371.000, z =-4.125, p=.000$, see table 1). To meet the assumptions for performing the ANCOVAs, the variable age was transformed with a square root formula (square root age).

2.5.3.2 Differences within elite judo athletes

In order to investigate differences among elite judo athletes with respect to the several parameters, three weight making classifications were made. The first rough classification was as follows: 1) elite judo athletes who were making weight before competitions and 2) elite judo athletes who were not losing weight before competitions. First, these two groups were compared on background variables age and BMI (see table 8). A significant difference was

found for age, where the weight making elite judo athletes were older (Md=19.00, n=88) than the elite judo athletes who were not making weight (Md=17.00, n=29), $U=955.500$, $z=-2.032$, $p=.042$. Therefore, age was taken as a covariate in further one way-analyses of covariance (ANCOVAs) to examine if elite judo athletes who were making weight differed from elite judo athletes who were not making weight regarding psychological complaints, diseases, injuries and performance. To meet the assumptions for performing the ANCOVAs, the variable age was transformed with a square root formula (square root age).

Table 8. Weight loss before competitions and Median scores for Age and BMI among elite judo athletes.

Level: Elite judo athletes	Weight loss before competitions (yes/no)	n (%)	Age Median (Md)	BMI Median (Md)
Elite	Yes	88 (75.2)	19.00 *	21.97
	No	29 (24.8)	17.00 *	22.16
Total		117	18.00	21.99

Note: A Chi-square analysis showed no significant differences on gender, $\chi^2(1, N = 117) = .000$, $p = 1.000$. In addition, a Mann-Whitney U test revealed no significant differences in BMI for elite judo athletes who were making weight (Md=21.97, n=87) and elite judo athletes who were not making weight (Md=22.16, n=116), $U=1227.000$, $z=-.220$, $p=.826$. * A significant difference was found on age for elite judo athletes who were making weight (Md=19.00, n=88) and elite judo athletes who were not making weight (Md=17.00, n=29), $U=955.500$, $z=-2.032$, $p=.042$.

The second classification regarding (ir)responsible weight making was based on one of the guidelines of the NOC*NSF: “a maximum weight loss between the 0.5 and 1.0 kilograms per week is the most optimal for the health and the performance of an athlete”. This information was obtained from question 24 “weight usually lost (kg) in the last week before competitions” (see appendix 1 questionnaire GMJ). The following three groups were created: 1) no weight loss (0 kg), 2) responsible weight loss (0.1-1 kg weight loss per week) and 3) irresponsible weight loss (>1kg per week). In order to investigate whether these three groups differed with respect to the different parameters, Kruskal-Wallis tests were performed while post hoc analyses were performed with Mann-Whitney U tests.

The third and last classification was based on another guideline of the NOC*NSF: “athletes must not exceed a maximum weight of 3% above their competitions weight during competition seasons”. This information was obtained from questions 25 (competition weight)

and question 21 (weight usually lost before competitions in kg) (see appendix 1, questionnaire GMJ). The following calculation was made: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score > 100 and ≤ 103) and 3) irresponsible weight loss (index score > 103). Again, Kruskal-Wallis and Mann-Whitney U tests were performed to compare these three. For an overview of the three above mentioned classifications see appendix 6.

The rejection criterion was set at $p \leq 0.05$ for all statistical analyses.

3. Results

3.1 Differences between elite and non-elite judo athletes regarding their weight loss behavior

When heavy weights were excluded, 72.6% of all the Dutch competitive judo athletes reported weight loss before competitions. This prevalence was very similar between elite (75.2%) and non-elite judo athletes (72.9%), $\chi^2(1, N=320) = .102, p = .749$. However, when comparing elite and non-elite judo athletes on specific weight making characteristics, the results of several one-way analyses of covariance (ANCOVAs) (with covariates gender, BMI and age) revealed significant differences between these groups.

To summarize, significant differences were found on the average weight usually lost before competitions (in kg and % of current body weight), the average weight usually regained after competitions (in kg) and the average maximum weight loss (in kg and % of current body weight) when comparing elite and non-elite judo athletes, $F_s(1, 207-233) > 10.606, p_s < .01$ (see table 9). Elite judo athletes reported a higher average weight loss before competitions of 3.4 % (SD=2.1) whereas non-elite judo athletes reported an average weight loss of 2.3 % (SD=1.4) of their current body weight. Likewise, the average weight regained in the week after competitions was more: 1.9% (SD=1.5) of their current body weight for elite judo athletes and 1.1 % (SD=1.0) of their current body weight for non-elite judo athletes. Finally, the average maximum weight loss was 6.4% (3.7) of their current body weight for elite judo athletes whereas non-elite judo athletes reported an average maximum weight loss of 4.0% (SD=2.3) of their current body weight.

With respect to the weight loss methods used, it was found that rapid (dietary) weight loss methods were more often used among elite judo athletes (M=2.04, SD=1.03) compared to non-elite judo athletes (M=1.33, SD=0.99) (see table 10a). Rapid (dietary) weight loss methods include: fasting, sauna, restricting fluid intake and skipping one or two meals (see also table 10b). In contrast, it was found that dehydration and training methods (i.e. training and/or wearing winter clothes, training in heated training rooms, increasing exercise and spitting) were more often used among non-elite judo athletes (M=1.32, SD=0.86) compared to elite judo athletes (M=1.20, SD=0.91) (see table 10a). This difference is attributable to the significant difference in the method “increasing exercise” with non-elite judo athletes using this method more often (M=2.56, SD=1.37) than elite judo athletes (M=2.18, SD=1.50) (see table 10b).

Finally, significant difference in the MW index scores (i.e. indicates the severity of weight loss procedures) were found when comparing elite and non-elite competitive judo athletes, $F(1, 186) = 5.384, p < .05$. Covariate effects were found for BMI, $F(1, 186) = 4.962, p < .05$ (figure 5). As shown in figure 1, the average on the MW index score is higher for elite judo athletes, indicating a more aggressive weight management behavior among elite judo athletes compared to non-elite judo athletes. To summarize, the above mentioned results are in accordance with the hypothesis that elite judo athletes would have a more aggressive weight management behavior compared to non-elite judo athletes.

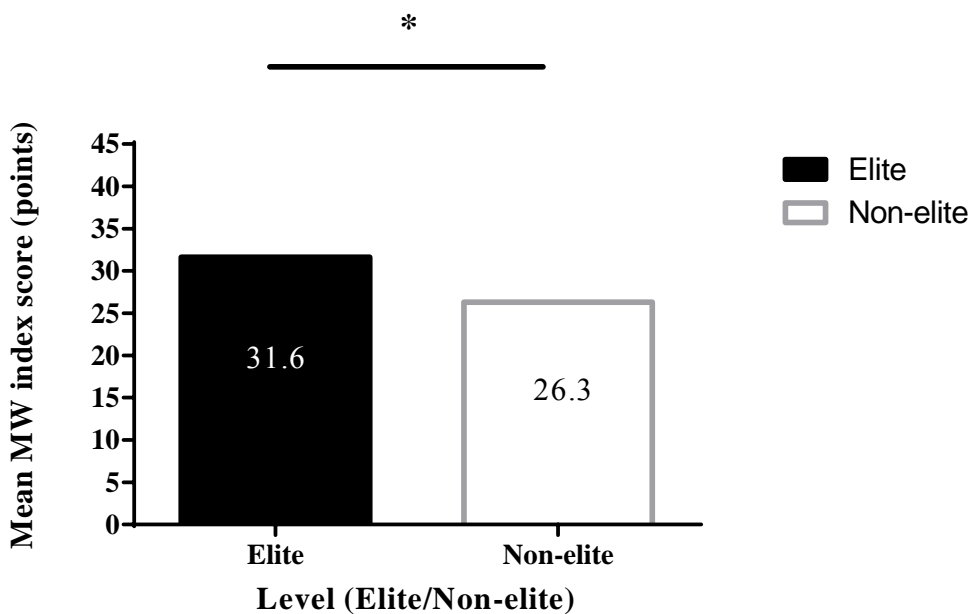


Figure 1. Mean scores MW index score for elite and non-elite judo athletes.

* $p < .05$

Note: The MW index score represents the extent to which judo athletes were making weight. The higher the score obtained by a judo athlete, the more aggressive and harmful his/her weight management behavior is.

Table 9. “Making weight” characteristics for Dutch elite and non-elite judo athletes with covariates gender, BMI and age.

Level (elite/ non-elite)	Age began cutting weight(yr)		Weight usually lost before competitions (kg)		Weight usually lost before competitions (%)		Weight usually lost in the last week before competitions (kg)		Weight usually Regained in the Week after competitions (kg)	
	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range
Elite	14.3±2.5	6-22	2.3±1.4*	0.5-6.0	3.4±2.1*	1-10	1.7±1.1	0-7	1.9±1.5*	1-42
Non-elite	13.2±3.1	6-32	1.5±1.1*	0.2-6.0	2.3±1.4*	0-8	1.4±1.0	0.1-8.0	1.1±1.0*	1-60
Total	13.6 ± 2.9	6-32	1.8 ± 1.3	0.2-6.0	2.7 ± 1.8	0-10	1.5 ± 1.1	0-8	1.4 ± 1.3	1-60

Table 9. “Making weight” characteristics for Dutch elite and non-elite judo athletes with covariates gender, BMI and age.

Level (elite/ non-elite)	Most weight loss(kg)		Maximum weight loss (%)		Number of times cut weight		Number of days in which weight is usually lost	
	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range
Elite	4.25±2.62*	0.5-13.9	6.36±3.70*	0.9-15.8	7.83±5.00	1-25	12.08±7.89	1-42
Non-elite	2.66±1.87*	0.2-12.0	4.03±2.30*	0.4-11.7	5.80±5.18	1-30	9.34±7.95	1-60
Total	3.2 ± 2.3	0.2-13.9	4.9 ± 3.1	0.4-15.8	6.6 ± 5.2	1-30	10.4 ± 8.0	1-60

* $p < .05$; ** $p < .01$

Note: significant overall group effects were found on weight usually lost before competitions (kg and %), weight usually regained (kg) and most weight loss (kg and %), $F_s(1, 207-233) > 10.606$, $ps < .01$

Note: Covariate effects were found for age on all variables, $F_s(1, 207-233) > 12.083$, $ps < .01$ and for BMI on all variables, $F_s(1, 207-233) > 11.833$, $ps < .01$, except for weight usually lost (in % of current body weight), weight usually regained in the week after competitions and most weight loss (in % of current body weight).

Table 10a. Average scores classifications of weight loss methods for Dutch elite and non-elite judo athletes

	Gradual weight loss	Pathogenic weight loss practices	Dehydration & training	Rapid (dietary) weight loss
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Elite	2.67±0.96	0.12±0.31	1.20±0.91*	2.04±1.03*
Non-elite	2.29±1.04	0.13±0.42	1.32±0.86*	1.33±0.99*
Total	2.43±1.03	0.12±0.38	1.27±0.88	1.60±1.07

$p < .05$; ** $p < .01$

Note: scales are running from 0=never to 4=always

Note: Gradual weight loss= restricting fat intake, restricting carbohydrate intake, restricting energy intake, increasing protein intake and gradual dieting. Pathogenic weight loss practices= diuretics, diet pills, laxatives and vomiting. Dehydration & training= training and/or wearing winter clothes, training in heated training rooms, increasing exercise and spitting. Rapid (dietary) weight loss= Restricting fluid intake, skipping one or two meals, fasting and sauna.

Note: significant overall group effects were found on dehydration & training, $F(1, 232) = 4.304$, $p < .05$ and rapid (dietary) weight loss, $F(1, 225) = 9.714$, $p < .01$.

Note: Dehydration & training: Covariate effects were found for BMI, $F(1, 232) = 6.041$, $p < .05$, Rapid (dietary) weight loss: covariate effects were found for age, $F(1, 225) = 11.273$, $p < .01$, BMI, $F(1, 225) = 9.424$, $p < .01$, and gender, $F(1, 225) = 6.326$, $p < .05$

Table 10b. Average scores weight loss methods for Dutch elite and non-elite judo athletes

	Fasting	Restricting fluid intake	Increasing exercise	Sauna
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Elite	1.38±1.41*	2.72±1.30*	2.18±1.50*	2.05±1.49*
Non-elite	0.86±1.25*	1.75±1.57*	2.56±1.37*	1.14±1.48*
Total	1.06±1.33	2.15±1.54	2.42±1.42	1.48±1.55

$p < .05$; ** $p < .01$

Note: scales are running from 0=never to 4=always

Note: Fasting: Covariate effects were found for BMI, $F(1, 233) = 8.819$, $p < .05$, Restricting fluid intake: covariate effects were found for age, $F(1, 239) = 8.712$, $p < .01$, BMI, $F(1, 239) = 5.150$, $p < .01$, and gender, $F(1, 239) = 6.516$, $p < .05$, Increasing exercise: covariate effects were found for gender, $F(1, 240) = 9.302$, $p < .01$, Sauna: covariate effects were found for age, $F(1, 238) = 11.750$, $p < .01$ and BMI, $F(1, 238) = 5.229$, $p < .05$.

3.2 Psychological complaints

3.2.1 The relation between making weight and psychological complaints

To investigate the relation between making weight and psychological complaints among elite judo athletes, Spearman's rank correlations analyses were performed. No significant correlations were found between the MW index score (indicating the severity of weight loss procedures) and psychological complaints among elite judo athletes. However, when looking at the specific items of the MW index score, the "relative number of weight cuts (number of weight cuts/number of competitions) was positively correlated with psychosomatic complaints, $\rho = .29$ ($p < .05$). In other words, the higher the number of relative weight cuts in the past year, the more often elite judo athletes experienced psychosomatic complaints. Moreover, small to moderate positive correlations were found with several classifications of weight loss methods (see table 11). Positive correlations with depression were found for pathogenic weight loss practices, $\rho = .24$ ($p < .05$), dehydration & training, $\rho = .25$ ($p < .05$) and rapid (dietary) weight loss, $\rho = .22$ ($p < .05$). A stronger correlation with depression was found for gradual weight loss, $\rho = .36$ ($p < .01$). Furthermore, a positive correlation was found between pathogenic weight loss practices and the overall score of the SCL-90, $\rho = .32$ ($p < .05$), indicating that the more often elite judo athletes were using aggressive and harmful methods to lose weight before competitions (i.e. diuretics, diet pills, laxatives and vomiting), the higher their level of overall psychological dysfunction. Positive correlations with anxiety were found for pathogenic weight loss practices, $\rho = .28$ ($p < .01$) and dehydration & training, $\rho = .22$ ($p < .05$). In addition, positive correlations with psychosomatic complaints were found for gradual weight loss, $\rho = .23$ ($p < .05$) and rapid (dietary) weight loss, $\rho = .23$ ($p < .05$), indicating that the more often elite judo athletes had lost weight before competitions (gradual or rapidly), the more often they experienced psychosomatic complaints. In the end, a positive correlation between dehydration & training and distrust and interpersonal sensitivity (SEN), $\rho = .24$ ($p < .05$), was found. In short, above mentioned results are in accordance with the hypothesis that the aggressiveness and severity of making weight would be positively related with psychological complaints among elite judo athletes.

Table 11. Spearman's rank correlation coefficients classifications weight loss methods and psychological complaints for Dutch elite judo athletes.

	Classifications weight loss methods				Psychological complaints		
	1.	2.	3.	4.	5.	6.	7.
Classifications weight loss methods							
1. Gradual weight loss	-	.062	.198	.322**	-.133	.051	.357**
2. Pathogenic weight loss practices		-	.361**	.221*	.047	.282*	.243*
3. Dehydration & training			-	.386**	.163	.218*	.250*
4. Rapid (dietary) weight loss				-	-.047	.142	.219*
Psychological complaints							
5..AGO					-	.307**	.227
6.ANX						-	.666**
7.DEP							-
8.SOM							
9.IN							
10.SEN							
11.HOS							
12.SLA							
13.OVER							

$p < .05$; ** $p < .01$

Note: Gradual weight loss= restricting fat intake, restricting carbohydrate intake, restricting energy intake, increasing protein intake and gradual dieting. Pathogenic weight loss practices= diuretics, diet pills, laxatives and vomiting. Dehydration & training= training and/or wearing winter clothes, training in heated training rooms, increasing exercise and spitting, Rapid (dietary) weight loss= Restricting fluid intake, skipping one or two meals, fasting and sauna.

Note: AGO=agoraphobia, ANX=anxiety, DEP=depression, SOM=psychosomatic complaints, IN=insufficiency of thinking and acting, SEN=distrust and interpersonal sensitivity, HOS=hostility, SLA=trouble with sleeping, OVER=overall score of all scales.

Table 11. Spearman's rank correlation coefficients classifications weight loss methods and psychological complaints for Dutch elite judo athletes.

	Psychological complaints					
	8.	9.	10.	11.	12.	13.
Classifications weight loss methods						
1.Gradual weight loss	.230*	-.009	.116	.106	.100	.049
2.Pathogenic weight loss practices	.044	.203	.122	.025	.180*	.318*
3.Dehydration&training	.021	.116	.238*	.158*	-.023	.214
4.Rapid (dietary) weight loss	.229*	.036	.163	.126	.081	.015
Psychological complaints						
5..AGO	.206	.236*	.323*	.125*	.073	.324**
6.ANX	.506**	.636**	.663**	.402**	.313**	.820**
7.DEP	.543**	.627**	.692**	.440**	.452**	.857**
8.SOM	-	.349**	.436**	.267**	.283**	.748**
9.IN		-	.653**	.418**	.348**	.748**
10.SEN			-	.370**	.401**	.835**
11.HOS				-	.397**	.525**
12.SLA					-	.597**
13.OVER						-

* $p < .05$; ** $p < .01$

Note: Gradual weight loss= restricting fat intake, restricting carbohydrate intake, restricting energy intake, increasing protein intake and gradual dieting. Pathogenic weight loss practices= diuretics, diet pills, laxatives and vomiting. Dehydration & training= training and/or wearing winter clothes, training in heated training rooms, increasing exercise and spitting, Rapid (dietary) weight loss= Restricting fluid intake, skipping one or two meals, fasting and sauna.

Note: AGO=agoraphobia, ANX=anxiety, DEP=depression, SOM=psychosomatic complaints, IN=insufficiency of thinking and acting, SEN=distrust and interpersonal sensitivity, HOS=hostility, SLA=trouble with sleeping, OVER=overall score of all scales.

3.2.2 Differences in psychological complaints between weight making and not weight making elite judo athletes

Several one-way analyses of covariance (ANCOVAs), with covariate age were performed, to compare weight making elite judo athletes with not weight making elite judo athletes regarding the prevalence of psychological complaints. The results of the ANCOVAs revealed no significant differences, $F_s(1, 71 \text{ to } 163) > 0.019, p_s > .124$ (see table 12).

Table 12. Average scores on psychological complaints (Standard Deviation) for weight making and not weight making Dutch elite judo athletes.

	Making weight: yes/no	Psychological complaints								
		AGO	ANX	DEP	SOM	IN	SEN	HOS	SLA	OVER
Elite(n=122)	Yes	7.43(0.98)	12.90 (2.75)	21.76 (4.83)	17.40 (3.81)	13.98 (3.96)	23.45 (6.38)	8.12 (2.66)	5.15 (2.47)	110.86 (19.21)
	No	7.20 (0.41)	12.34 (3.36)	20.96 (6.77)	17.93 (4.59)	12.76 (3.03)	22.97 (4.92)	7.69 (1.61)	4.76 (1.64)	109.41 (24.57)

Note: AGO=agoraphobia, ANX=anxiety, DEP=depression, SOM=psychosomatic complaints, IN=insufficiency of thinking and acting, SEN=distrust and interpersonal sensitivity, HOS=hostility, SLA=trouble with sleeping, OVER=overall score of all scales.

Note: maximum score AGO=35, ANX=50, DEP=80, SOM=60, IN=45, SEN=90, HOS=30, SLA=15, OVER=405

3.2.3 Differences in psychological complaints between not weight making, responsible or irresponsible weight making elite judo athletes

A Kruskal-Wallis test was performed to examine whether the following three groups differed regarding the prevalence of psychological complaints: 1) no weight loss (0 kilograms), 2) responsible weight loss (weight loss between the 0.1 and 1.0 kilograms per week before competitions) and 3) irresponsible weight loss (weight loss of more than 1 kg per week before competitions). The results revealed no significant differences, $\chi^2(2, n = 58-106) > 0.485, p_s > .176$ (see table 13, appendix 7).

Likewise, the results of a Kruskal-Wallis test revealed no significant differences when the following three groups were compared regarding the prevalence of psychological complaints: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score > 103), $\chi^2(2, n = 58-103) > 0.065, p_s > .124$ (see table 14,

appendix 7).

3.3 Diseases

3.3.1 The relation between “making weight” and diseases

Spearman’s rank correlations analyses were performed to examine the relation between making weight and diseases among elite judo athletes. A significant positive correlation was found between the MW index score and diarrhea, $\rho = .29$ ($p < .05$), indicating that the more aggressive and harmful the weight management behavior of the elite judo athletes, the more often they experienced diarrhea. More specifically, the separate item of the MW index score, “average weight loss before competitions (in % of current body weight)”, was positively correlated with diarrhea, $\rho = .23$ ($p < .05$). In addition, positive correlations were found for dehydration & training with vomiting, $\rho = .23$ ($p < .05$), and diseases, $\rho = .22$ ($p < .05$), indicating that the more often elite judo athletes were using dehydration & training methods to lose weight before competitions, the more often they had to vomit and the more often they generally experienced diseases. Finally, the subscale pathogenic weight loss practices was strongly correlated with vomiting, $\rho = .77$ ($p < .01$) (see table 15). The above mentioned findings among elite judo athletes are partly in agreement with the hypothesis that, among elite judo athletes, making weight would be positively related with the prevalence of diseases.

Table 15. Spearman's rank correlation coefficients classifications weight loss methods and diseases for Dutch elite judo athletes.

	Classifications of weight loss methods				Diseases		
	1.	2.	3.	4.	5.	6.	7.
Classifications weight loss methods							
1. Gradual weight loss	-	.062	.198	.322**	-.019	-.009	.011
2. Pathogenic weight loss practices		-	.361**	.221*	.180	.767**	.109
3. Dehydration & training			-	.386**	.079	.233*	.217*
4. Rapid (dietary) weight loss				-	.100	.093	.042
Diseases							
5. Diarrhea					-		
6. vomiting						-	
7. Mean score diseases (without menstrual complaints)							-

* $p < .05$; ** $p < .01$

Note: Gradual weight loss= restricting fat intake, restricting carbohydrate intake, restricting energy intake, increasing protein intake and gradual dieting. Pathogenic weight loss practices= diuretics, diet pills, laxatives and vomiting. Dehydration & training= training and/or wearing winter clothes, training in heated training rooms, increasing exercise and spitting, Rapid (dietary) weight loss= Restricting fluid intake, skipping one or two meals, fasting and sauna.

3.3.2 Differences in diseases between weight making and not weight making elite judo athletes

Several one-way analyses of covariance (ANCOVAs) with covariate age were performed to compare weight making elite judo athletes with not weight making elite judo athletes regarding the prevalence of diseases. The results of the ANCOVA revealed a significant overall group effect on vomiting, $F(1, 114) = 8.963, p < .003$ without a covariate effect for age. The results indicated that elite judo athletes who were not making weight had to vomit more often ($M=0.41, SD=0.501$) than elite judo athletes who were making weight ($M=0.13, SD=0.450$). The average scores on the diseases among elite judo athletes are represented in table 16.

Table 16. Average scores on diseases (Standard Deviation) for weight making and not weight making Dutch elite judo athletes

	Making weight: yes/no	Diseases								
		Having a cold	A sore throat	The flu	vomiting	diarrhea	Dry mouth	Muscle cramps	Conditional loss	Menstrual complaints
Elite(n=122)	Yes	1.70 (0.89)	1.26 (0.82)	0.86 (0.67)	0.13 (0.45)*	1.13 (0.78)	1.49 (0.97)	1.13 (0.93)	1.14 (0.94)	0.86 (1.07)
	No	1.69 (0.76)	1.07 (0.70)	0.86 (0.69)	0.41 (0.50)*	1.03 (0.63)	1.38 (0.86)	1.07 (0.88)	1.03 (0.98)	1.08 (1.26)

$p < .05$; ** $p < .01$

note: scale running from 0=not at all to 4=very often.

Table 16. Average scores on diseases (Standard Deviation) for weight making and not weight making Dutch elite judo athletes.

	Making weight: yes/no	Diseases	
		Mean score diseases (without menstrual complaints)	Mean score diseases (with menstrual complaints)
Elite(n=122)	Yes	1.10 (0.44)	1.10 (0.39)
	No	1.07 (0.43)	1.21 (0.52)

$p < .05$; ** $p < .01$

Note: scale running from 0=not at all to 4=very often.

3.3.3 Differences in diseases between not weight making, responsible and irresponsible weight making elite judo athletes

A Kruskal-Wallis test was performed to compare the following three groups regarding the prevalence of diseases: 1) no weight loss (0 kilograms), 2) responsible weight loss (weight loss between the 0.1 and 1.0 kilograms per week before competitions), 3) irresponsible weight loss (weight loss of more than 1 kg per week before competitions). The results revealed a statistically significant difference in vomiting across the three different groups, $\chi^2(2, 106) = 19.906, p = .000$. Post hoc analyses with Mann-Whitney U tests illustrated a significant difference between group 1 (no weight loss), with a mean rank of 37.37 and group 2 (responsible weight loss) with a mean rank of 24.33, $U = 221.500, z = -4.100, p = .00$ and a significant difference between group 1 (no weight loss) with a mean rank of 44.00 and group 3 (irresponsible weight loss) with a mean rank of 32.17, $U = 368.000, z = -3.046, p = .002$. In other words, elite judo athletes who had not lost weight before competitions had to vomit more often than elite judo athletes who engaged in responsible or irresponsible weight loss procedures. For an overview of the mean scores and the Mean Rank scores for the three different groups on the several diseases variables see table 17, appendix 7.

Again, a Kruskal-Wallis test was performed to compare the following three groups: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score > 103). The results revealed a significant difference in diarrhea across the three different groups, $\chi^2(2, 102) = 6.105, p = .047$. Post hoc analysis with Mann-Whitney U tests indicated a significant difference between group 2 (responsible weight loss) with a mean rank of 35.11 and group 3 (irresponsible weight loss) with a mean rank of 46.46, $U = 571.500, z = -2.394, p = .017$, indicating that elite judo athletes who engaged in irresponsible weight loss procedures reported to experience diarrhea more often than elite judo athletes who engaged in responsible weight loss procedures.

Likewise, the results of a Kruskal-Wallis test revealed a significant difference in vomiting across these three different groups, $\chi^2(2, 103) = 19.233, p = .000$. Post hoc analyses with Mann-Whitney U tests indicated significant differences between group 1 (no weight loss) with a mean rank of 42.00 and group 2 (responsible weight loss) with a mean rank of 28.40, $U = 275.000, z = -3.847, p = .000$ and between group 1 (no weight loss), with a mean rank of 37.75 and group 3 (irresponsible weight loss) with a mean rank of 26.30, $U = 258.500, z = -3.253, p = .001$. Elite judo athletes who had not lost weight before competitions (index score ≤ 100) had to vomit more often than elite judo athletes who engaged in responsible (index score 100-103) or irresponsible weight loss procedures (index score > 103).

For an overview of the mean scores and the Mean Rank scores for the three different groups on the several diseases variables see table 18, appendix 7.

3.4 Injuries

3.4.1 The relation between making weight and injuries

Among all elite judo athletes, no significant correlations were found with the MW index score. However, the separate item of the MW index score “weight usually lost before competitions (in % of current body weight)” was positively correlated with the sum of acute injuries last year, $\rho = .22$ ($p < .05$), indicating that the higher the usual weight loss among elite judo athletes before competitions, the more acute injuries they had in the past year.

3.4.2 Differences in injuries between weight making and not weight making elite judo athletes

To investigate whether elite judo athletes who were making weight before competitions differed from elite judo athletes who were not making weight before competitions several one -way analyses of covariance (ANCOVAs) with covariate age were performed. The results of the ANCOVAs revealed no significant differences, $F_s(1, 53 \text{ to } 114) > 0.411$, $p_s > .080$ (see table 19).

Table 19. Average scores on injuries (Standard Deviation) for weight making and not weight making Dutch elite judo athletes

		Making weight: yes/no		Sum acute injuries last year		Sum chronic injuries last year		Total injuries last year		Ratio 1	Ratio 2
		M(SD)	Range	M(SD)	Range	M (SD)	range	M (SD)	M(SD)		
Elite(n=122)	Yes	0.48 (0.73)	0-3	0.18 (0.52)	0-3	0.66 (0.80)	0-3	0.73 (0.44)	0.27 (0.44)		
	No	0.79 (1.05)	0-3	0.10 (0.31)	0-1	0.90 (1.18)	0-4	0.89 (0.28)	0.11 (0.28)		

Note: Ratio 1= number of acute injuries/total number of injuries, Ratio 2=number of chronic injuries/number of total injuries.

3.4.3. Differences in injuries between not weight making, responsible and irresponsible weight making elite judo athletes

Regarding the second classification (see appendix 6), a Kruskal Wallis test was performed in order to examine the difference between the following three groups regarding the prevalence of injuries: 1) no weight loss (0 kilograms), 2) responsible weight loss (weight loss between the 0.1 and 1.0 kilograms per week before competitions, 3) irresponsible weight loss (weight loss of more than 1 kg per week before competitions). The results of the Kruskal-Wallis test revealed no significant differences between these three groups with respect to the prevalence of injuries, $\chi^2(2, n = 51-106) > 1.444, ps > .068$. For an overview of the mean scores and the Mean Rank scores for the three different groups on the several injuries variables see table 20, appendix 7.

Likewise, with respect to the third classification (see appendix 6), a Kruskal Wallis test was performed in order to compare the following three groups regarding the prevalence of injuries: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score > 103). The results revealed no significant differences between the three groups, $\chi^2(2, n = 51-103) > 0.953, ps > .241$. The mean scores and the Mean Rank scores of the three groups on the several injuries variables are illustrated in table 21, appendix 7.

3.5 Performance

3.5.1 The relation between making weight" and performance

To examine the relation between making weight and performance among elite judo athletes, Spearman's rank correlations analyses were performed. No significant correlations were found between the MW index score and the performance variables. However, small to strong correlations were found with separate items of the MW index score. As shown in table 22, weight usually lost (in kg) was negatively correlated with the absolute number of medals, $\rho = -.36 (p < .01)$ and the relative number of medals past year, the so called performance ratio, $\rho = -.24 (p < .05)$, indicating that the more weight elite judo athletes usually lost before competitions (in kg), the less medals they had won. Other findings were the moderate to strong negative correlations between the maximum weight loss (in kg and % of current body weight) and the relative number of weight cuts (number of weight cuts/number of competitions) on the one hand and the absolute number of medals and the performance ratio

on the other, ρ 's \leq $-.32$ ($p < .01$) (see also table 14). In other words, the higher the maximum weight loss (in kg and % of current body weight) and the higher the relative number of weight cuts (number of weight cuts/number of competitions), the less medals elite judo athletes had won in the past year and the lower their performance ratio. In addition, the weight usually regained after competitions (in kg and % of current body weight) was negatively related with the absolute number of medals. Furthermore, weak to moderate negative correlations were found between rapid (dietary) weight loss and both the absolute number of medals, $\rho = -.37$ ($p < .01$) as well as the performance ratio, $\rho = -.23$ ($p < .05$) indicating that the more often elite judo athletes were using rapid (dietary) weight loss methods (i.e. restricting fluid intake, skipping one or two meals, fasting and sauna) before competitions, the less medals they had won in the past year and the lower their performance ratio. In the end the gradual weight loss method: "restricting carbohydrate intake" was negatively correlated with the absolute number of medals, $\rho = -.33$ ($p < .01$).

Table 22. Spearman's rank correlation coefficients separate items of MW index score and performance variables for Dutch elite judo athletes.

	Separate items of MW index score							Performance variables			
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Separate items of MW index score											
1. Weight usually lost (kg)	-	.961**	.767**	.744**	.840**	.794**	.620**	-.360**	-.244*	-.077	-.058
2. Weight usually lost (%)		-	.689**	.735**	.784**	.805**	.582**	-.285*	-.180	-.010	-.088
3. Most weight loss (kg)			-	.956**	.680**	.615**	.647**	-.506**	-.323**	-.170	.025
4. Most weight loss (%)				-	.649**	.640**	.616**	-.476**	-.290**	-.133	.008
5. Regain (kg)					-	.976**	.434**	-.261*	-.208	-.087	-.073
6. Regain (%)						-	.408**	-.221*	-.174	-.054	-.081
7. Relative number of weight cuts							-	-.556**	-.355**	-.164	.065
Performance variables											
8. Number of medals								-	.733**	.425*	-.076
9. Performance ratio									-	.423**	-.145
10. "I am satisfied about my judo performances"										-	-.319**
11. Losing weight negatively influences my performances"											-

* $p < .05$; ** $p < .01$

3.5.2 Differences in performance between weight making and not weight making elite judo athletes

Several one-way analyses of covariance (ANCOVAs) with covariate age were performed to examine whether weight making elite judo athletes differed from not weight making elite judo athletes regarding the several performance variables. The results of the ANCOVAs revealed no significant differences, $F_s(1, 92 \text{ to } 113) > 0.097, p_s > .077$ (see table 23).

Table 23. Average scores on several performance variables (Standard Deviation) for weight making and not weight making Dutch elite judo athletes

		Making weight: yes/no			
		Number of medals won in the past year	Performance ratio	“I am satisfied about my judo performances”	“Losing weight negatively influences my performances”
		M(SD)	M(SD)	M (SD)	M (SD)
Elite(n=122)	Yes	8.70 (7.17)	0.65 (0.45)	3.56 (1.14)	2.43(1.23)
	No	8.15(7.04)	0.60 (0.24)	4.07 (0.75)	2.56 (1.51)

Note: The scales with respect to the statements “I am satisfied about my own judo performance” and “losing weight negatively influences my performance” are running from 1 (totally disagree) to 5 (totally agree).

3.5.3. Differences in performance between not weight making, responsible and irresponsible weight making elite judo athletes

A Kruskal-Wallis test was performed to compare the following three groups regarding the several performance variables: 1) no weight loss (0 kilograms), 2) responsible weight loss (between the 0.1 and 1 kilogram weight loss per week before competitions) and 3) irresponsible weight loss (>1 kilogram weight loss per week before competitions). The results revealed a significant difference across the three groups on the statement: “I am satisfied about my own judo performance”, $\chi^2(2, n=105) = 7.440, p < .05$. Post hoc analyses with Mann-Whitney U tests revealed a significant difference between group1 (no weight loss) with a mean rank score of 34.87 and group 2 (responsible weight loss) with a mean rank score of

25.97, $U=279.000$, $z=-2.081$, $p=.04$, and a significant difference between group 1 (no weight loss) with a mean rank of 44.48 and group 3 (irresponsible weight loss) with a mean rank of 31.11, $U=334.000$, $z=-2.733$, $p=.01$. Likewise, the results of a Kruskal-Wallis test revealed a significant difference across the following three groups: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score > 103), on the same statement "I am satisfied about my own judo performance", $\chi^2 (2, n=102) = 6.190$, $p < .05$. Post hoc analyses with Mann-Whitney U tests illustrated significant differences between group 1 (no weight loss) with a mean rank of 38.52 and group 2 (responsible weight loss) with a mean rank of 29.35, $U=329.500$, $z=-1.978$, $p=.05$, and a significant difference between group 1 (no weight loss) with a mean rank of 37.45 and group 3 (irresponsible weight loss) with a mean rank of 26.47, $U=265.000$, $z=-2.502$, $p=.01$. To summarize, elite judo athletes who were not losing weight were more satisfied with their performance than elite judo athletes who were losing weight in a responsible or irresponsible manner. For an overview of the mean scores and the Mean Rank scores on the several performance variables see table 24 and 25, appendix 7

4. Discussion

The main purpose of the present study was to investigate the relation between “making weight” and psychological complaints, diseases, injuries and performance among Dutch elite judo athletes in order to achieve “healthy” judo practice. At first, it was hypothesized that the weight loss behavior of the elite judo athletes would be more aggressive than the weight loss behavior of non-elite judo athletes. Furthermore, it was hypothesized that, among elite judo athletes, “making weight” would be positively related to the prevalence of psychological complaints, diseases and injuries and would be negatively related with the performance and the attitude of the elite judo athletes towards their own performance.

As expected, the results illustrated that elite judo athletes showed more aggressive weight loss behaviors than non-elite judo athletes. More specifically, elite judo athletes reported a higher average weight loss before competitions and a higher weight gain after competitions. Moreover, the most weight ever lost before a competition was higher among elite judo athletes. In addition, it appeared that elite judo athletes used rapid (dietary) weight loss methods (i.e. fasting, sauna, restricting fluid intake and skipping one or two meals) more often. They also obtained a higher scorer on the MW index score (i.e. indicates the severity of weight loss procedures), indicating a more aggressive weight management behavior. These findings are in line with the earlier mentioned results of Artioli et al. (2010), who found that more aggressive weight management strategies are used among judo athletes in higher competition levels.

With respect to the hypothesis that making weight would be positively related to psychological complaints among elite judo athletes, supportive results were found. The higher the number of relative weight cuts in the past year, the more often elite judo athletes experienced psychosomatic complaints. Moreover, small positive correlations were found between pathogenic weight loss practices, dehydration & training and rapid (dietary) weight loss on the one hand and depression (as measured with the SCL-90) on the other hand. However, a much stronger positive correlation was found between gradual dieting and depression. The strong relation between gradual dieting and depression is a possible explanation for the fact that judo athletes might know that it is better to use gradual weight loss methods but find it difficult to persevere due to depressive symptoms. As a consequence,

they might turn to other more rapid, aggressive and harmful practices. Furthermore, a positive relation between pathogenic weight loss practices and the overall score of the SCL-90 (OVER) indicated that the more often elite judo athletes were using harmful and aggressive weight loss methods before competitions, the higher their level of overall psychological dysfunction. In addition, both gradual weight loss and rapid (dietary) weight loss were positively related with psychosomatic complaints. Other findings were the correlations between pathogenic weight loss practices and dehydration & training methods on the one hand and anxiety as measured with the SCL-90 on the other. In sum, these findings are in agreement with other studies where it was found that weight loss adversely affects the psychology of judo athletes (Degoutte et al, 2006; Filaire et al. (2001), Franchini et al, 2012; Koral & Dosseville, 2009). Important to note is that the different weight loss methods were also correlated with each other. As a consequence, it was difficult to get a reliable view of the relation between the used weight loss methods and psychological complaints. In contrast, no significant differences were found between weight making elite judo athletes and not weight making elite judo athletes regarding the prevalence of psychological complaints. However, this classification (weight making versus not weight making elite judo athletes) only roughly differentiated between weight making and not weight making elite judo athletes which made it almost impossible to detect differences between the several groups. A more detailed classification which differentiates for the manner in which elite judo athletes are making weight (e.g. specific weight loss methods, time in which weight is lost, amount of weight loss etc.) would be more accurate to detect differences in psychological complaints. Likewise, no significant differences in psychological complaints were found between elite judo athletes who had not lost weight before competitions and elite judo athletes who engaged in responsible or irresponsible weight management procedures. However, up to present there are no studies who found significant differences in psychological complaints between not weight making judo athletes, responsible and irresponsible weight making judo athletes. Previous studies mainly focused on assessing different mood states and emotions with the POMS questionnaire instead of measuring specific psychological complaints (Degoutte et al., 2006; Filaire et al., 2007; Koral & Dosseville, 2009; Mc Nair, Lorr & Droppleman, 1971). In addition, one might take into consideration that the guidelines of the NOC*NSF used for these classifications (i.e. no weight loss, responsible and irresponsible weight loss) were created with caution which made it very hard to detect differences. For example, Strien (2007) created a guideline that states that a maximum weight loss of 0.5 kilogram per week is the most optimal in

stead of the recommend maximum of 1 kg per week according to the NOC*NSF.

The hypothesis regarding the relation between making weight and diseases was partly confirmed by the results. The more aggressive and harmfulness the weight management behavior of the elite judo athletes and the more weight they had lost before competitions, the more often they reported diarrhea. Further, the more often elite judo athletes used dehydration & training methods the more often they had to vomit and the more often they experienced diseases. Also the weight loss classification: “pathogenic weight loss practices” was positively correlated with vomiting. Elite judo athletes who engaged in irresponsible weight loss procedures reported to experience diarrhea more often than elite judo athletes who engaged in responsible weight loss procedures. A positive relation between weight loss and diarrhea and vomiting could be partly explained by previous studies about eating disorders that argue that disordered eating is frequently associated with disturbances in the functioning of the upper gastrointestinal tract (Zipfel et al., 2006). Moreover, other studies found that weight loss has serious detrimental effects on the immune system which in turn results in a decreased resistance to diseases (Alderman et al., 2004; Chandra, 1991; Chaouachi et al., 2009; Kowatori et al., 2000 ; Pedersen & Bruunsgaard, 1995; Kowatari et al., 2000; Pyne, 1994; Shephard, 1991; Tsai et al., 2011). However, the correlations between weight loss and vomiting and diarrhea are very logical when it is considered that both these disease symptoms are also included as weight loss methods in the questionnaire GMJ (see appendix 1). The results also indicated that elite judo athletes who were not making weight had to vomit more often than elite judo athletes who were making weight, whether it was in a responsible or irresponsible manner, according to the guidelines of the NOC*NSF. An explanation for these contrasting results might have been the underreporting of diarrhea and vomiting particularly in the weight making group.

With respect to the expectation that making weight would be positively related to the prevalence of injuries, only for acute injuries a supportive result was found. The higher the weight usually lost among elite judo athletes before competitions, the more acute injuries they had in the past year. This result is in line with previous studies who argue that judo athletes who engage in weight loss procedures before competitions have an increased risk of developing injuries (Green et al., 2007; Tsai et al., 2011).

In general, supportive results were found for the hypothesis: “making weight will be

negatively related to the performance of elite judo athletes". Negative relationships were found between the average weight loss, the maximum weight loss, the relative number of weight cuts and the weight loss classification "rapid (dietary)weight loss" on the one hand and the number of relative and absolute medals on the other. These findings are in accordance with previous studies where it was argued that making weight impairs the performance of judo athletes (Degoutte et al., 2006; Filaire et al., 2001). Furthermore, the results also illustrated that elite judo athletes who engaged in responsible or irresponsible weight loss procedures were less satisfied about their own performances than elite judo athletes who had not lost weight before competitions. Since there are no studies up to present that support this result, it would be of great value to further investigate the relation between making weight and the subjective performance of judo athletes in future research. It was also found that restricting carbohydrates has a negative relationship with performance. This finding might suggest that the ingestion of carbohydrates could improve performance. Previous studies about the effect of carbohydrates intake on performance found that performance among athletes improves by ingestion of carbohydrates before and/or during exercise (Currel & Jeukendrup, 2008; Welsh, Davis, Burke & Williams, 2002; Wright, Sherman & Dernbach, 1991). Moreover, Horswill, Hickner, Scott, Costill & Gould (1990) reported an average of 1.5% improvement in performance in a group that lost weight with a high-carbohydrate diet as compared with an average of 8.8% decrement in performance in a group that lost weight with a low-carbohydrate diet.

It should be acknowledged that the present study has several limitations. First, this study relied only on self-report questionnaires. Self-report questionnaires have an important source of bias: social desirability. In other words, participants may be prone to reporting socially desirable behavior aspects rather than real behavior (Baarda, de Goede & Kalmijn, 2007; Haynes, Heiby & Hersen 2003). The questionnaires used in the present research, the GMJ and the SCL-90, include questions which inquire about private and possible sensitive information. These questions might evoke a tendency towards social desirability among participants or concern about the possible consequences of reporting this private and sensitive information (Tourangeau & Yan, 2007). Second, during the completion of the questionnaires, it became clear that participants needed more time than expected to fill out the questionnaires. The longer it takes to fill out a questionnaire, the greater the chance that fatigue, boredom and

distraction negatively influence the attention and effort of participants (Herzog & Bachman, 1981). Third, the conditions in which the survey took place were not optimal. In some judo clubs, it was not possible to perform the survey in a separate room or meeting room. In these cases, the questionnaires were filled out in the judo gym where it was difficult to create a quiet working environment. In addition, a large number of judo athletes were close together when filling out the questionnaires which resulted in communication with others. Fourth, judo athletes often use a combination of different weight loss methods (e.g. dehydration, restricting energy intake and restricting fluid intake) which makes it difficult to interpret the consequences of a specific weight loss method on the health and performance of a judo athlete (Artioli et al., 2010). In addition, this study used the results of a factor analysis to make classifications of weight loss methods (see table 5 appendix 7 for the results of the factor analysis and appendix 6 for the classifications). However, there are multiple ways in which weight loss methods can be classified. Choosing a different classification could have led to other results. Fifth, the average weight loss before competitions, the weight loss in the last week before competitions, the maximum weight loss, and the weight regained after competitions were calculated in percentage of the current body weight. However, it is important to note that using the competition weight or the upper limit of each weight class as a reference point to calculate these percentages would have given other results. In future studies it may be more accurate to calculate these variables in percentage of both the current body weight as well as in percentage of the competition weight and in percentage of the upper limit of each weight class to get a more detailed and reliable view of weight loss among judo athletes. It should also be noted that only a cross-sectional design was used in the present study, which made it impossible to gain knowledge about underlying causes that might have led to harmful and aggressive weight loss procedures among the Dutch elite competitive judo athletes. This knowledge is very important in preventing harmful consequences of weight loss among elite judo athletes.

Future research should focus on both the underlying influences which lead to harmful and aggressive weight management behavior as well as the intermediating factors and consequences of making weight. In this respect, a longitudinal design or a pre- to post-test design would be more accurate. To get more insight in making weight among judo athletes, it might be interesting to also include some physiological and anthropometric variables measures in future research to increase the reliability of the data. With respect to the research conditions, future research should consider to perform the

research in an environment with optimal conditions (quiet working environment, no distractions etc.). Moreover, it may be important to develop a more compact questionnaire with specific classifications which differentiate in the manner in which judo athletes are making weight to get more reliable results.

Based on the present study it can be concluded that the weight loss behavior among elite judo athletes is more aggressive and harmful than the weight loss behavior among non-elite judo athletes. When focusing on elite judo athletes, it appeared that weight loss was related with more psychological complaints (i.e. depression, psychosomatic complaints, anxiety and a higher psychological dysfunction), more acute injuries and more diseases such as diarrhea. Furthermore, making weight appeared to have a negative relationship with objective and subjective performance. Moreover, it was found that restricting carbohydrates has a negative relationship with performance. These mentioned negative relationships above were especially found when the weight making behaviors were more severe and aggressive according to the MW-index score or its separate items.

To summarize, the theoretical knowledge of this study enlarges the existing knowledge concerning making weight among judo athletes. Moreover, the results of this study provides useful information for the Dutch judo federation and their accompanying sports medical framework (e.g. sports doctors, sports psychologists and sport dieticians) and sports technical framework (coaches) who are part of the NOC*NSF. This new insight in making weight and its consequences can be a major contribution in promoting healthy judo practice among Dutch elite competitive judo athletes. For example, a practical implication could be the development of guidelines in order to prevent aggressive and harmful weight management procedures. Further, another practical implication could be the implementation of psycho education among judo clubs in the Netherlands in order to make elite judo athletes, coaches, parents etc. more aware of the consequences of making weight. Particularly, if judo athletes are taught that aggressive weight making and restricting carbohydrates seemed to have a negative impact on the health and the performance, they might become more convinced to use less harmful practices. Future studies can use the results of this study as a reference point because it has been the first study to look at the relation between making weight and psychological complaints, diseases, injuries and performance among elite judo athletes.

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Appendix

Appendix 1. Questionnaire: Making Weight among Judo athletes (GMJ)

ONDERZOEK NAAR AFVALLEN TER VOORBEREIDING OP JUDOWEDSTRIJDEN

Eerst verantwoordelijke onderzoekers:

Dr. A.P. (Karin) de Bruin

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De vragen hebben betrekking op de voorbereiding van het deelnemen aan judowedstrijden in een bepaalde gewichtsklasse.

ALGEMENE INFORMATIE

- 1 Geboortedatum: _____ (maand) _____ (jaar)
- 2 Geslacht: man/vrouw (doorhalen wat niet van toepassing is)
- 3 Wat is je lengte? _____ cm
- 4 Wat is je huidige gewicht? _____, _____ kilo (gewicht steeds in decimalen nauwkeurig, bijv. 64,7 kilo)
- 5 a Wanneer is je vetpercentage voor het laatst gemeten? _____ (dag) _____ (maand) _____ (jaar)
b Wat was je vetpercentage toen? _____ %
c Gemeten door: huidplooiemeting/impedantiemeter (doorhalen wat niet van toepassing is)
d Wat was je gewicht toen? _____, _____ kilo
- 6 Op welke leeftijd ben je begonnen met judo: _____ jaar
- 7 Op welke leeftijd ben je begonnen met judowedstrijden: _____ jaar
- 8 Hoeveel uren train je per week voor je sport? _____ uren
 - a Judotraining _____ uur
 - b Conditie/cardiotraining _____ uur
 - c Krachttraining _____ uur
- 9 Ben je (lichamelijk) actief in andere sporten?
 Ja, ik besteed _____ uur, aan de volgende andere sporten: _____
 Nee
- 10 Wanneer was je laatste judowedstrijd? _____ (dag) _____ (maand) _____ (jaar)
- 11 Wanneer is je eerstvolgende judowedstrijd? _____ (dag) _____ (maand) _____ (jaar)
- 12 Op welk niveau neem je deel aan judowedstrijden? Kruis aan welk(e) niveau(s).
 Clubkampioenschappen
 Regionale wedstrijden
 Nationale Kampioenschappen
 Internationale Kampioenschappen
- 13 Aan hoeveel wedstrijden heb je het afgelopen jaar deelgenomen? _____ wedstrijden
(reken 1 jaar terug vanaf de datum van invullen van deze vragenlijst)
- 14 Hoeveel medailles heb je het afgelopen jaar gewonnen? _____ medailles
(reken 1 jaar terug vanaf de datum van invullen van deze vragenlijst)

15 Wat zijn je belangrijkste prestaties tot nu toe?

GEWICHTSGESCHIEDENIS EN DIEETPATROON

16 a In welke gewichtsklasse kom je nu uit? Tot _____ kilo

b Wie heeft/hebben invloed gehad op de keuze om in deze gewichtsklasse uit te komen?
Kruis het antwoord aan dat het beste bij je past.

Jijzelf (eventueel) in overleg met: _____

Ouders (eventueel) in overleg met: _____

Coach (eventueel) in overleg met: _____

Iemand anders: _____ (eventueel) in overleg met: _____

17 Ben je in de afgelopen twee jaar van gewichtsklasse veranderd?

Ja, ik ben eerder uitgekomen in de volgende gewichtsklasse: Tot _____ kilo
Kun je aangeven wat de reden voor verandering van gewichtsklasse is geweest?

Nee, ik ben de afgelopen twee jaar steeds in dezelfde gewichtsklasse uitgekomen.

18 Hoeveel woog je maximaal buiten het afgelopen wedstrijdseizoen? _____, _____ kilo
(reken 1 jaar terug vanaf het invullen van de vragenlijst)

19 Ben je ooit gericht afgevallen om deel te kunnen nemen aan een judowedstrijd?

Ja

Nee, ik heb nog nooit af hoeven vallen om te kunnen deelnemen aan een judowedstrijd
(ga verder naar vraag 33)

20 Op welke leeftijd viel je voor het eerst af ter voorbereiding op een judowedstrijd? _____ jaar

21 Hoeveel kilo lichaamsgewicht val je normaal gesproken af voor wedstrijden? _____, _____ kilo

- 22 Hoeveel kilo ben je maximaal afgevallen om te kunnen deelnemen aan een judowedstrijd in de door jou gewenste gewichtsklasse? _____, _____ kilo
- 23 In hoeveel dagen tijd val je normaal gesproken af voor wedstrijden? _____ dagen
- 24 Hoeveel kilo val je normaal gesproken af in de laatste week voor een wedstrijd? _____, _____ kilo
- 25 Hoeveel kilo weeg je gemiddeld als je de mat op stapt op de wedstrijddag? _____, _____ kilo
- 26 Hoeveel kilo kom je normaal gesproken aan in de week na de wedstrijd? _____, _____ kilo
- 27 Hoeveel kilo weeg je gemiddeld tussen je laatste en eerstvolgende wedstrijd? _____, _____ kilo
- 28 Hoe vaak ben je in het afgelopen wedstrijdseizoen afgevallen om te kunnen deelnemen aan een judowedstrijd? (reken 1 jaar terug vanaf het invullen van de vragenlijst)
_____ keer
- 29 Geef met onderstaande schaal aan hoeveel invloed de betrokkenen of bronnen hebben gehad op de door jou gehanteerde methode(n) om af te vallen? (Bijvoorbeeld: wie heeft je aangemoedigd en/of geleerd om af te vallen.) Omcirkel het antwoord dat het beste bij je past. Scoor alle items.

	Geen invloed	Bijna geen invloed	Neutraal	Beetje invloed	Veel invloed
Andere judoka's/trainingspartners	1	2	3	4	5
Oudere (meer ervaren) judoka's	1	2	3	4	5
Arts	1	2	3	4	5
Judocoach	1	2	3	4	5
Fysiotherapeut	1	2	3	4	5
Ouders	1	2	3	4	5
Diëtist	1	2	3	4	5
Kracht-/conditietrainer	1	2	3	4	5
Boeken en/of tijdschriften	1	2	3	4	5
Internet/social media	1	2	3	4	5
Iemand/iets anders; namelijk: _____	1	2	3	4	5

- 30 Onderstaande tabel bevat verschillende methoden om in gewicht af te vallen. Geef in de tabel aan hoe vaak je elk van deze methoden hebt gebruikt om jouw streefgewicht te bereiken. Omcirkel het antwoord dat het beste bij je past. Scoor alle items.

	Altijd	Soms	Bijna nooit	Nooit	Niet meer
Geleidelijk diëten (afvallen in 2 weken of meer)	1	2	3	4	5
Overslaan van 1 of 2 maaltijden	1	2	3	4	5
Vasten (de hele dag niet eten)	1	2	3	4	5
Beperken energie inname (minder calorieën)	1	2	3	4	5
Beperken vetinname	1	2	3	4	5
Beperken koolhydraatinname	1	2	3	4	5
Verhogen van eiwitinname	1	2	3	4	5
Beperken vochtinname	1	2	3	4	5
Meer trainen (meer dan normaal)	1	2	3	4	5
Bewust in verwarmde trainingsruimtes trainen	1	2	3	4	5
Saunabezoek	1	2	3	4	5
Trainen in rubber of plastic regen- of winterkleding	1	2	3	4	5
Het dragen van winter-/regen-/plastic kleding gedurende dag en/of nacht (wanneer je niet traint)	1	2	3	4	5
Spekssel uitspugen	1	2	3	4	5
Laxeermiddelen (middelen om de ontlasting op gang te brengen)	1	2	3	4	5
Diuretica (zogenoemde plaspillen)	1	2	3	4	5
Dieetpillen (bijv. afslankpillen)	1	2	3	4	5
Braken	1	2	3	4	5
Anders, namelijk:					

31 Welk(e) van bovenstaande afvalmethoden gebruik je het meest en waarom? (Denk aan bijvoorbeeld: makkelijkst om vol te houden, werkt het snelst enz.)

a Methode: _____

Reden: _____

b Methode: _____

Reden: _____

c Methode: _____

Reden: _____

32 Word je bij het afvallen begeleid?

Nee

Ja, ik word begeleid door: _____

STELLINGEN

33 Hieronder staat een aantal stellingen over jou als sporter, over de judosport en over afvallen. Beantwoord alle stellingen door het antwoord dat het beste bij je past te omcirkelen.

	<i>Helemaal oneens</i>	<i>Beetje oneens</i>	<i>Neutraal</i>	<i>Beetje eens</i>	<i>Helemaal eens</i>
Ik ben tevreden over mijn judoprestaties.	1	2	3	4	5
Ik stel mezelf extreem hoge doelen in mijn sport.	1	2	3	4	5
Ik geloof in mezelf.	1	2	3	4	5
Ik vind het vreselijk om niet de beste te zijn in mijn sport.	1	2	3	4	5
Ik verlies mijn zelfvertrouwen redelijk snel.	1	2	3	4	5
Afvallen hoort bij de judosport.	1	2	3	4	5

	Helemaal oneens	Beetje oneens	Neutraal	Beetje eens	Helemaal eens	Niet van toepassing
Ik vind afvallen een leuk onderdeel van de judosport.	1	2	3	4	5	
Ik heb voorlichting gehad over hoe ik het beste kan afvallen.	1	2	3	4	5	
Ik heb behoefte aan voorlichting over hoe ik het beste kan afvallen.	1	2	3	4	5	
Naast een weging moeten judoka's ook getest worden op de mate van vochtverlies.	1	2	3	4	5	
Aan het begin van het seizoen moet voor iedere judoka een minimumgewicht worden vastgesteld voor het komende seizoen.	1	2	3	4	5	
Uitkomen in een lagere gewichtsklasse verhoogt mijn kansen op succes.	1	2	3	4	5	
Ik voel druk van anderen om af te vallen.	1	2	3	4	5	
Een laag vetpercentage (minder dan 12% voor vrouwen of minder dan 5% voor mannen) is wenselijk voor een topjudoka.	1	2	3	4	5	
Een koolhydraatarm dieet is de beste manier om af te vallen en een goede sportprestatie te leveren.	1	2	3	4	5	
Drie uur is voldoende tijd om te herstellen na het afvallen.	1	2	3	4	5	
Het kost mij veel moeite om af te vallen om mijn wedstrijdgewicht te halen.	1	2	3	4	5	NVT
Wanneer ik bezig ben met afvallen ben ik uit mijn doen.	1	2	3	4	5	NVT
Afvallen heeft een negatief effect op mijn sportprestatie.	1	2	3	4	5	NVT
Ik ben bang voor de negatieve gevolgen op mijn gezondheid die op lange termijn door het afvallen kunnen ontstaan.	1	2	3	4	5	NVT
Wanneer ik nu meer dan 5 % van mijn lichaamsgewicht zou moeten afvallen, zou ik dat te veel vinden en niet doen.	1	2	3	4	5	NVT
Als ik goed wil presteren, moet ik niet meer dan 1 kilo per week afvallen.	1	2	3	4	5	NVT
Als ik af moet vallen begin ik ruim van tevoren (meer dan 2 weken) op vocht af te vallen (extra zweten, weinig drinken, bezoek aan sauna, etc).	1	2	3	4	5	NVT
Tijdens het afvallen moet ik krachttraining doen om verlies van spiermassa tegen te gaan.	1	2	3	4	5	NVT

REGELWIJZIGING

- 34 De Internationale Judo Federatie heeft per 2013 de regels betreffende het wegen van de judoka veranderd. De regelwijziging houdt in dat de judoka de avond voor de wedstrijd om 19.00 uur wordt gewogen. Om te kijken hoeveel men aankomt wordt men op de wedstriiddag, tijdens de Judogi controle nogmaals gewogen (dit telt niet mee voor gewichtscntrole). Hieronder staat een aantal stellingen over deze regelwijziging. Beantwoord alle stellingen door het antwoord dat het beste bij je past te omcirkelen.

	Helemaal oneens	Beetje oneens	Neutraal	Beetje eens	Helemaal eens	Niet van toepassing
Nu ik (door de regelwijziging) op de dag vóór de wedstrijd word gewogen, voel ik me beter op de wedstriiddag.	1	2	3	4	5	6
De regelwijziging maakt dat ik mij anders op een wedstrijd voorbereid.	1	2	3	4	5	6
Nu ik (door de regelwijziging) al op de avond voor de wedstrijd word gewogen, begin ik later met afvallen.	1	2	3	4	5	6
De regelwijziging is een verbetering voor de judosport.	1	2	3	4	5	6
Het is beter als er maximaal 1 uur tussen de weging en de wedstrijd zit.	1	2	3	4	5	6

LICHAMELIJKE GEZONDHEID

- 35 Gebruik je medicijnen?

Nee

Ja, namelijk: _____

- 36 Gebruik je voedingssupplementen?

Nee

Ja, namelijk: _____

37 Volg je een dieet om medische redenen?

Nee

Ja, namelijk: _____

38 Vul in onderstaande tabel de blessures in die je hebt gehad. (Wanneer je nog nooit een blessure hebt gehad, mag je deze vraag overslaan.)

a ____ (maand) ____ (jaar)

Type blessure _____

b ____ (maand) ____ (jaar)

Type blessure _____

c ____ (maand) ____ (jaar)

Type blessure _____

d ____ (maand) ____ (jaar)

Type blessure _____

e ____ (maand) ____ (jaar)

Type blessure _____

39 In onderstaande tabel staan verschillende gezondheidsklachten. Omcirkel in de tabel hoe vaak je deze gezondheidsklachten ervaart. Scoor alle items.

	Helemaal niet	Bijna niet	Af en toe	Vaak	Heel vaak
(Neus)Verkoudheid	1	2	3	4	5
Keelpijn	1	2	3	4	5
Griep	1	2	3	4	5
Braken (overgeven)	1	2	3	4	5
Diarree	1	2	3	4	5
Droge mond	1	2	3	4	5
Spierkrampen	1	2	3	4	5
Conditieverlies	1	2	3	4	5
Alleen voor meisjes/vrouwen:					
Menstruatiestoornissen (onregelmatige of uitblijvende menstruatie)	1	2	3	4	5

MENSTRUATIE

Onderstaande vragen zijn alléén voor vrouwen en meisjes bij wie minstens één menstruatie heeft plaatsgevonden. Vrouwen en meisjes die nog nooit gemenstrueerd hebben, hoeven de vragen niet te beantwoorden.

- 40 Op welke leeftijd begon je met menstrueren? _____ jaar
- a Is jouw menstruatiecyclus vanaf het begin regelmatig? Ja Nee
 - b Is jouw menstruatie de laatste paar maanden wel eens uitgebleven? Ja Nee
 - c Hoe vaak menstueerde je in de laatste 3 maanden? _____ keer
 - d Gebruik je orale anticonceptiemiddelen (de pil)? Ja Nee
 - e Ben je zwanger of geef je momenteel borstvoeding? Ja Nee

VRAGEN EN OPMERKINGEN

Appendix 2. Questions and scores individual questions RWLQ (arteoli et al., 2010)

WEIGHT HISTORY AND DIET PATTERNS.

10. In which weight class do you compete? under _____ kg.
11. Did you change your weight class in the last two years?
() **yes. In which weight classes did you compete?** _____.
() **no, I competed in the same weight class in the last two years**
12. How much did you weigh in the last judo off-season (*especificy the year*)? _____ kg.
13. Have you ever lost weight in order to compete?
() **Yes.** (please continue aswering the rest of the questionnaire)
() **No, I have never cut weight to compete** (thank you for your help - do not answer the following questions).
14. What is the MOST WEIGHT that you have cut to compete in your career? _____ kg.
15. How many times did you cut weight to compete last season (*especificy the year*)? _____ times.
16. How much weight do you **usually** cut before competitions? _____ kg.
17. In how many days do you **usually** cut weight before competitions? _____ days.
18. At what age did you begin to cut weight for competitions? _____ years old.
19. How much weight do you usually regain in the week following a competition? _____ kg/week.

20. Using the scale below, please rate the amount of influence that each individual listed below has had on your weight loss practices. (i.e.: who encouraged and taught you to lose weight) (check all items)

1 2 3 4 5
not influential little influential unsure some influential very influential

- () another judoka/training colleague () judo coach/ sensei;
 () fellow judoka; () parents;
 () physician/doctor; () dietitian;
 () physical trainer; () other. Explain _____

21. The table below presents several methods to lose weight rapidly. Using the table below, HOW OFTEN did you use each one of the following methods to lose weight before competitions? (Check all items).

Gradual dieting (lose weight in 2 weeks or more)	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Skipping 1 or 2 meals	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Fasting (not eating all day)	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Restricting fluids ingestion	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Increased exercises (more than usual)	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Training intentionally in heated training rooms	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Saunas	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Training with rubber/plastic suits	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Use winter or plastic suits during the whole day and/or night (without exercising)	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Spitting	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Laxatives	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Diuretics	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Diet pills	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()
Vomiting	always ()	sometimes ()	almost never ()	never used ()	I don't use anymore ()

Scores:

Question 13: yes=53 points; no=50 points

Question 14= 0.5 points per kg

Question 15=1 point per time

Question 16=1 point per kg

Question 17:

1–3 days=5 points

4–5 days=4 points

6–7 days=3 points

8–10 days=2 points

11–14 days=1 point

15 days or more=0 points

Question 18:

14 years or less=5 points

15 years= 4 points

16 years= 3 points

17 years= 2 points

18 years=1 point

19 years or more= 0 points

Question 19= 1 point per kg

Question 21:

Always= 3 points per method

Sometimes= 2 points per method

almost never= 1 point per method

never used = 0 points

I don't use anymore= 0.5 point per method

“gradual dieting” and “increased exercising = 0
points

“laxatives”, “diuretics”, “diet pills” and “vomiting”
= frequency score x 2

Appendix 3. Introduction letter research

Maart, 2013

Beste judoka/ouders/verzorgers,

In samenwerking met Judo Bond Nederland, de Vrije Universiteit Amsterdam, de Universiteit Utrecht en de faculteit der Bewegingswetenschappen hebben Drs. Jessica Gal (sportarts) en Dr. Karin de Bruin (sportpsycholoog) een onderzoek opgezet naar afvallen ter voorbereiding op judowedstrijden. In het kader van dit onderzoek is er een vragenlijst samengesteld die verschillende aspecten rondom deze voorbereiding uitvraagt. Deze vragenlijst zal worden afgenomen onder een grote groep judoka's om meer zicht te krijgen op deze voorbereiding en hoe judoka's daarmee omgaan.

Middels deze brief willen wij om medewerking aan dit onderzoek vragen. In totaal zal dit onderzoek, bestaande uit een viertal vragenlijsten, ongeveer 30 minuten in beslag nemen. Er zijn geen risico's verbonden aan dit onderzoek. Wij vragen alleen naar eigen meningen en ervaringen. Er bestaat dus geen goed of fout antwoord. Tevens zullen de resultaten volledig anoniem behandeld en verwerkt worden.

De vragenlijsten zullen tijdens de training (met goedkeuring van de trainer/coach) worden ingevuld. Bij deelname willen wij vragen om de toestemmingsverklaring deelnemer in te vullen. Als deelnemers jonger zijn dan 16 jaar, moet ook de toestemmingsverklaring ouders/verzorgers ingevuld en ondertekend bij de onderzoekers worden ingeleverd.

Wanneer u vragen heeft, kunt u contact met ons opnemen via de contactgegevens onderaan deze brief. Ook voor eventuele (hulp)vragen die na deelname aan het onderzoek bij u opkomen, kunt u ons benaderen.

Alvast vriendelijk bedankt!

Met vriendelijke groet,

Eerst verantwoordelijke onderzoekers: Dr. A.P. (Karin) de Bruin/ Drs. J.S.I. (Jessica) Gal

Mede-onderzoekers: J.G. (Jocelyn) Petter BSc. / R. (Robin) Ellerstrom

CONTACTGEGEVENS

KARIN DE BRUIN Sportpsycholoog

JESSICA GAL Sportarts

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T 06-42485149

T 06-24634821

Appendix 4. Informed consent parents/guardians

TOESTEMMINGSVERKLARING OUDERS/VERZORGERS ten behoeve van wetenschappelijk onderzoek getiteld: 'Onderzoek naar afvallen ter voorbereiding op judowedstrijden'

Ik verklaar hierbij op voor mij duidelijke wijze, mondeling en schriftelijk, te zijn ingelicht over de aard, risico's en belasting van het onderzoek waaraan mijn zoon/dochter gevraagd is deel te nemen. Mijn vragen zijn naar tevredenheid beantwoord. Ik geef toestemming om mijn zoon/dochter deel te laten nemen aan dit onderzoek. Ik en mijn zoon/dochter, behouden het recht deze instemming weer in te trekken zonder dat daarvoor een reden voor hoeft te worden opgegeven.

Achternaam en voorletters kind: _____

Geboortedatum: _____

Achternaam en voorletters ouder/ verzorger: _____

Handtekening ouder/verzorger: _____

Datum: _____

Ik heb mondelinge en schriftelijke toelichting verstrekt over het onderzoek. Ik verklaar mij bereid nog opkomende vragen over het onderzoek naar vermogen te beantwoorden.

13 maart 2013

Eerst verantwoordelijke onderzoekers:



dr. A.P. (Karin) de Bruin



drs. J.S.I. (Jessica) Gal

Onderzoekers: _____

J.G. (Jocelyn) Petter BSc. en R. (Robin) Ellerstrom

Datum: _____

Handtekening: _____

Appendix 5. Informed consent participant



JESSICA GAL
SPORTARTSEN



Karin de Bruin
sportpsycholoog



Universiteit Utrecht



Faculteit der Bewegingswetenschappen

Toestemmingsverklaring participant(e) ten behoeve van wetenschappelijk onderzoek getiteld:

'Onderzoek naar afvallen ter voorbereiding op judowedstrijden'

Ik verklaar hierbij op voor mij duidelijke wijze, mondeling en schriftelijk, te zijn ingelicht over de aard en belasting van het onderzoek waaraan ik deelneem. Mijn eventuele vragen zijn naar tevredenheid beantwoord. Ik geef vrijwillig toestemming voor deelname aan dit onderzoek. Ik behoud het recht deze instemming weer in te trekken zonder dat daarvoor een reden voor hoeft te worden opgeven.

Achternaam en voorletters:

Handtekening*: Datum:.....

* Wanneer u geen handtekening heeft, kunt u er een krabbeltje of iets dergelijks neerzetten.

Ik heb mondelinge en schriftelijke toelichting verstrekt over het onderzoek. Ik verklaar mij bereid nog opkomende vragen over het onderzoek naar vermogen te beantwoorden.

Eerst verantwoordelijke onderzoeker: dr. A.P. (Karin) de Bruin/ drs. J.S.I. (Jessica) Gal

Handtekening :

Datum:

Naam Onderzoekers: J.G. (Jocelyn) Petter BSc./ E. (Evi) Sommen / J. (Jessica) Nellisen

Handtekening : Datum:.....

Appendix 6. Classifications

The following classifications are made in this research:

Classification 1.

- 1) Elite judo athletes who were making weight before competitions.
- 2) Elite judo athletes who were not making weight before competitions.

Classification 2.

This classification is based on the following guideline of the NOC*NSF: “a maximum weight loss between the 0.5 and 1.0 kilograms per week is the most optimal for the health and the performance of an athlete”. This information is obtained from question 24 (“weight usually lost in the last week before competitions, see appendix 1 questionnaire GMJ). The following three groups are created: 1) no weight loss (0 kg), 2) responsible weight loss (0.1-1 kg weight loss per week), 3) irresponsible weight loss (>1 kg per week).

Classification 3.

This classification is based on the following guideline of the NOC*NSF: “athletes must not exceed a maximum weight of 3% above their competitions weight during competition seasons”. This information is obtained from the questions 25 (competition weight) and 21 (weight usually lost before competitions in kilograms) (see appendix 1, questionnaire GMJ). The following calculation is made: $\text{index score} = ((\text{competition weight} + \text{weight usually lost in kg}) / \text{competition weight}) * 100$. The index scores are classified as follows: 1) no weight loss (index score ≤ 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score > 103).

Appendix 7. Tables

Table 2. Overview excluded participants.

Exclusion criteria	Number of excluded participants
Younger than 12 years	19
Competition experience of less than 2 years	13
Not participating in competitions anymore	6
Weight loss in the past thus not currently losing weight	4
Did not seriously fill out the questionnaire	10
heavyweights	8
Total	60

Table 3. SCL-90: Description of the nine symptom dimensions.

Symptom dimensions	Description
ANX	Anxiety
AGO	Agoraphobia: avoiding places which provoke anxiety
DEP	Depression
SOM	Psychosomatic (physical) complaints
IN	Insufficiency of thinking and acting
SEN	Distrust and Interpersonal sensitivity: feelings of personal inadequacy and inferiority in comparisons with others.
HOS	Hostility, aggressiveness
SLA	Trouble with sleeping
OVER	Psycho neuroticism scale/Overall scale: overall level of psychological dysfunction

Table 5. Oblimin pattern matrix for the 18 weight losing methods.

Methods	Factor 1 “Gradual weight loss”	Factor 2 “Pathogenic weight loss practices”	Factor 3 “Dehydration & training”	Factor 4 “Rapid (dietary) weight loss”
Restricting fat intake	.749			
Restricting carbohydrate intake	.707			
Restricting energy intake	.706			
Increasing protein intake	.644			
Gradual dieting	.569			
Diuretics		.888		
Diet pills		.850		
Laxatives		.730		
Vomiting		.603		
Training in winter clothes			-.679	
Wearing winter cloths			-.675	
Training in heated training rooms			-.667	
Increasing exercise			-.507	
Spitting		.316	-.439	
Restricting fluid intake				-.782
Skipping one or two meals				-.768
Fasting				-.695
Sauna				-.475
Reliability	0.74	0.75	0.67	0.70
Mean (SD)	2.43 (1.03)	0.12 (0.38)	1.27 (0.88)	1.60 (1.07)
n	247	244	241	234

Table 6. Overview eight diseases and mean scores.

Diseases
Having a cold
A sore throat
The flu
Vomiting
Diarrhea
A dry mouth
Muscle cramps
Loss of condition
Menstrual complaints(only for females)
Mean scores diseases
Mean score diseases (without menstrual complaints)= (Sum (having a cold, a sore throat, the flu, vomiting, diarrhea, a dry mouth, muscle cramps, loss of condition))/8
Mean score diseases (with menstrual complaints, only for females)= (Sum (having a cold, a sore throat, the flu, vomiting, diarrhea, a dry mouth, muscle cramps, loss of condition, menstrual complaints))/9
<i>Note:</i> original scale (1=not at all, 2=almost never, 3=sometimes, 4=often, 5=very often), Converted scale (0=not at all, 1=almost never, 2=sometimes, 3=often, 4=very often)

Table 7. Overview variables injuries.

Variables injuries	explanation
“Acute number of injuries in the past year”	Number of injuries in the past year in which the injuries were incurred as a result of an accident during judo practices or competitions.
“Chronic number of injuries in the past year”	Number of injuries in the past year in which the injuries were a result of overusing one area of the body over a long period during judo practices or competitions.
“Total number of injuries in the past year”	Sum acute injuries + Sum chronic injuries in the past year
“Relative number of acute injuries in the past year”	Sum acute injuries/total injuries in the past year
“Relative number of chronic injuries in the past year”	Sum chronic injuries/total injuries in the past year

Table 13. Mean scores and Mean Rank scores on different scales of the SCL-90 for the following three groups: 1) no weight loss (0kg), 2) responsible weight loss (0.1-1 kg per week) and 3) irresponsible weight loss (>1.0 kg per week).

Weight loss behavior : three groups	SCL-90: Psychological complaints																	
	AGO	ANX		DEP		SOM		IN		SEN		HOS		SLA		OVER		
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (0 kg)	7.20 (0.41)	33.10	12.57 (3.60)	45.76	20.60 (6.19)	42.28	18.00 (4.67)	53.68	12.52 (3.15)	44.22	22.83 (4.46)	52.39	7.65 (1.61)	50.37	4.96 (1.74)	55.85	108.83 (23.99)	26.88
Responsible weight loss (0.1-1.0 kg per week)	7.72 (1.27)	38.31	13.20 (3.01)	57.71	22.21 (5.26)	54.74	17.78 (3.83)	53.58	14.06 (3.50)	56.90	24.77 (7.96)	56.40	7.94 (2.26)	50.97	4.94 (2.11)	52.00	115.19 (19.32)	34.72
Irresponsible weight loss (>1.0 kg per week)	7.24 (0.75)	31.06	12.77 (2.65)	53.03	21.51 (4.74)	51.02	17.23 (3.90)	49.11	13.98 (4.30)	53.37	22.36 (4.45)	48.38	8.39 (3.03)	54.73	5.29 (2.74)	53.47	108.00 (18.97)	27.77

Note: AGO=agoraphobia, ANX=anxiety, DEP=depression, SOM=psychosomatic complaints, IN=insufficiency of thinking and acting, SEN=distrust and interpersonal sensitivity, HOS=hostility, SLA=trouble with sleeping, OVER=overall score of all scales.

Table 14. Mean scores and Mean Rank scores on different scales of the SCL-90 for the following three groups: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Weight loss behavior : three groups	SCL-90 : Psychological complaints																	
	AGO	ANX		DEP		SOM		IN		SEN		HOS		SLA		OVER		
	M(SD)	Mean Rank score	M (SD) Rank Score	Mean Rank Score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	Mean Rank score	M(SD) Rank score	
No weight loss (index score \leq 100)	7.20 (0.41)	31.90	12.57 (3.60)	46.61	20.60 (6.19)	41.61	18.00 (4.67)	55.19	12.52 (3.15)	44.52	22.83 (4.46)	52.80	7.65 (1.61)	49.64	4.96 (1.64)	53.18	108.83 (23.99)	27.61
Responsible weight loss (index score 100-103)	7.72 (1.27)	35.77	13.20 (3.01)	46.71	22.21 (5.26)	46.71	17.78 (3.83)	44.78	14.06 (3.50)	50.21	24.77 (7.96)	44.11	7.94 (2.26)	51.38	4.94 (2.11)	48.12	115.19 (19.32)	29.14
Irresponsible weight loss (index score $>$ 103)	7.24 (0.75)	31.08	12.77 (2.65)	56.46	21.51 (4.74)	56.46	17.23 (3.90)	54.08	13.98 (4.30)	55.61	22.36 (4.45)	56.22	8.39 (3.03)	51.38	5.29 (2.74)	55.71	108.00 (18.97)	30.70

Note: AGO=agoraphobia, ANX=anxiety, DEP=depression, SOM=psychosomatic complaints, IN=insufficiency of thinking and acting, SEN=distrust and interpersonal sensitivity, HOS=hostility, LA=trouble with sleeping, OVER= overall score of all scales.

Note: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Table 17. Mean scores and Mean Rank scores on the several diseases variables for the following three groups: 1) no weight loss (0kg), 2) responsible weight loss (0.1-1 kg per week) and 3) irresponsible weight loss (>1.0 kg per week).

Weight loss behavior : three groups	Diseases											
	Having a cold		Sore throat		The flu		Vomiting		Diarrhea		Dry mouth	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (0 kg)	1.65 (0.78)	51.93	1.09 (0.60)	48.91	0.83 (0.72)	52.20	0.48 (0.51)	69.37**	1.04 (0.64)	51.70	1.30 (0.77)	46.70
Responsible weight loss (0.1-1.0 kg per week)	1.71 (0.79)	55.41	1.40 (0.81)	59.71	1.06 (0.74)	60.93	0.03 (0.17)	45.99**	1.03 (0.82)	50.63	1.59 (0.96)	55.68
Irresponsible weight loss (>1.0 kg per week)	1.71 (0.99)	52.85	1.15 (0.85)	51.17	0.71 (0.62)	47.77	0.19 (0.57)	51.38**	1.15 (0.72)	55.40	1.46 (1.00)	51.93

$p < .05$; ** $p < .01$

note: scale running from 0=not at all to 4=very often.

Table 17. Mean scores and Mean Rank scores on the several diseases variables for the following three groups: 1) no weight loss (0kg), 2) responsible weight loss (0.1-1 kg per week) and 3) irresponsible weight loss (>1.0 kg per week).

Weight loss behavior : three groups	Muscle cramps		Loss of condition		Menstrual complaints		Mean score(without menstrual complaints)		Mean score(with menstrual complaints)	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (0 kg)	0.87 (0.87)	46.87	0.83 (0.83)	46.80	1.10 (1.37)	28.00	1.01 (0.41)	47.11	1.11 (0.52)	24.95
Responsible weight loss (0.1-1.0 kg per week)	1.23 (0.97)	57.97	1.14 (0.97)	56.90	1.00 (1.26)	27.13	1.14 (0.50)		1.13 (0.39)	59.67
Irresponsible weight loss (>1.0 kg per week)	1.06 (0.89)	53.42	1.04 (0.85)	54.23	0.67 (0.86)	23.98	1.06 (0.42)	52.06	1.05 (0.41)	24.33

$p < .05$; ** $p < .01$

Note: scale running from 0=not at all to 4=very often.

Table 18. Mean scores and Mean Rank scores on the several diseases variables for the following three groups: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Weight loss behavior : three groups	Diseases											
	Having a cold		Sore throat		The flu		Vomiting		Diarrhea		Dry mouth	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (index score \leq 100)	1.64 (0.79)	49.48	1.05 (0.58)	47.07	0.82 (0.73)	50.45	0.50 (0.51)	68.25**	1.05 (0.65)	49.48	1.32 (0.78)	48.09
Responsible weight loss (index score 100-103)	1.60 (0.82)	49.34	1.16 (0.72)	51.37	0.86 (0.56)	53.07	0.09 (0.37)	46.72**	0.93 (0.71)	45.11*	1.24 (0.93)	46.15
Irresponsible weight loss (index score $>$ 103)	1.87 (0.94)	56.47	1.29 (0.93)	55.57	0.81 (0.70)	50.30	0.16 (0.55)	48.57**	1.34 (0.71)	59.74*	1.65 (58.23

$p < .05$; ** $p < .01$

Note: scale running from 0=not at all to 4=very often.

Note: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Table 18. Mean scores and Mean Rank scores on the several diseases variables for the following three groups: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Weight loss behavior : three groups	Diseases									
	Muscle cramps		Loss of condition		Menstrual complaints		Mean score(without menstrual complaints)		Mean score(with menstrual complaints)	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (index score \leq 100)	0.91 (0.87)	46.77	0.82 (0.85)	44.52	1.10 (1.37)	26.20	1.01 (0.42)	46.45	1.11 (0.52)	23.65
Responsible weight loss (index score 100-103)	1.19 (0.93)	55.35	1.14 (0.92)	55.20	0.95 (1.08)	25.68	1.02 (0.42)	48.52	1.02 (0.38)	21.39
Irresponsible weight loss (index score $>$ 103)	1.08 (0.97)	51.24	1.05 (0.84)	52.71	0.85 (1.14)	23.75	1.16 (0.45)	59.14	1.18 (0.36)	28.05

$p < .05$; ** $p < .01$

Note: scale running from 0=not at all to 4=very often.

Note: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Table 20. Mean scores and Mean Rank scores on the several injuries variables for the following three groups: 1) no weight loss (0kg), 2) responsible weight loss (0.1-1 kg per week) and 3) irresponsible weight loss (>1.0 kg per week).

Weight loss behavior : three groups	Injuries									
	Sum acute injuries past year		Sum chronic injuries past year		Sum total number of injuries past year		Ratio 1		Ratio 2	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (0 kg)	0.87 (1.10)	60.02	0.13 (0.34)	54.22	1.00 (1.24)	58.09	0.87 (0.30)	26.33	0.31 (0.30)	25.67
Responsible weight loss (0.1-1.0 kg per week)	0.46 (0.74)	49.79	0.31 (0.72)	58.31	0.77 (0.91)	55.16	0.64 (0.48)	21.78	0.36 (0.48)	30.22
Irresponsible weight loss (>1.0 kg per week)	0.54 (0.74)	53.08	0.04 (0.20)	49.65	0.58 (0.74)	50.09	0.90 (0.30)	29.43	0.10 (0.30)	22.57

Note: Ratio 1= number of acute injuries/total number of injuries, Ratio 2=number of chronic injuries/number of total injuries.

Table 21. Mean scores and Mean Rank scores on the several injuries variables for the following three groups: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Weight loss behavior : three groups	Injuries									
	Sum acute injuries past year		Sum chronic injuries past year		Sum total number of injuries past year		Ratio 1		Ratio 2	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (index score \leq 100)	0.91 (1.11)	59.02	0.14 (0.35)	52.82	1.05 (1.25)	57.14	0.87 (0.30)	26.33	0.13 (0.30)	25.67
Responsible weight loss (index score 100-103)	0.47 (0.77)	47.56	0.23 (0.65)	53.40	0.70 (0.91)	49.99	0.71 (0.45)	23.74	0.29 (0.45)	28.26
Irresponsible weight loss (index score $>$ 103)	0.58 (0.72)	52.96	0.08 (0.27)	49.95	0.66 (0.71)	51.30	0.85 (0.37)	27.95	0.15 (0.37)	24.05

Note: Ratio 1= number of acute injuries/total number of injuries, Ratio 2=number of chronic injuries/number of total injuries.

Note: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Table 24. Mean scores and Mean Rank scores on the several performance variables for the following three groups: 1) no weight loss (0kg), 2) responsible weight loss (0.1-1 kg per week) and 3) irresponsible weight loss (>1.0 kg per week).

Weight loss behavior : three groups	Performance variables							
	Number of medals won in the past year		Performance ratio		“Losing weight negatively influences my own performances”		“I am satisfied about my own judo performances”	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (0 kg)	9.05 (6.74)	54.24	0.63 (0.26)	53.71	2.86 (1.57)	50.93	4.26 (0.62)	67.35*
Responsible weight loss (0.1-1.0 kg per week)	9.88 (7.00)	58.50	0.64 (0.23)	56.41	2.41 (1.31)	42.97	3.63 (1.11)	50.79*
Irresponsible weight loss (>1.0 kg per week)	6.70 (4.58)	45.21	0.57 (0.27)	46.96	2.45 (1.12)	44.65	3.51 (1.12)	47.63**

$p < .05$; ** $p < .01$

Note: The scales with respect to the statements “I am satisfied about my own judo performances” and “losing weight negatively influences my performances” are running from 1 to 5.

Table 25. Mean scores and Mean Rank scores on the several performance variables for the following three groups: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Weight loss behavior : three groups	Performance variables							
	Number of medals won in the past year		Performance ratio		“Losing weight negatively influences my own performances”		“I am satisfied about my own judo performances”	
	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank	M (SD)	Mean Rank
No weight loss (index score \leq 100)	8.30 (5.96)	50.63	0.61 (0.26)	50.70	3.17 (1.47)	55.83	4.23 (0.61)	64.48*
Responsible weight loss (index score 100-103)	9.52 (7.19)	54.89	0.63 (0.25)	53.14	2.44 (1.21)	42.93	3.62 (1.13)	49.40*
Irresponsible weight loss (index score $>$ 103)	6.73 (4.69)	44.11	0.57 (0.27)	46.05	2.27 (1.10)	39.68	3.50 (1.13)	46.30*

$p < .05$

Note: index score = ((competition weight+ weight usually lost in kg)/competition weight)*100. The index scores were classified as follows: 1) no weight loss (index score \leq 100), 2) responsible weight loss (index score 100-103) and 3) irresponsible weight loss (index score $>$ 103).

Note: The scales with respect to the statements “I am satisfied about my own judo performances” and “losing weight negatively influences my performances” are running from 1 to 5.