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BODY COMPOSITION AND HYDRATION STATUS IN YOUNG ELDERLY WOMEN AFTER 6 WEEKS' MONAVIE JUICE SUPPLEMENTATION

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ABSTRACT

This study was designed to determine the influence of 6 weeks' MonaVie juice supplementation on body composition and hydration status in young elderly physically active women. Sixteen women, students of University of Third Age, were recruited for this study. All women were physically active (daily energy expenditure 1681.8 ± 297.6 kcal/d). Women were divided into 2 groups: 8 of them applied a supplement MonaVie juice (100 ml/d) (S) for 6 weeks, while the eight other women were allocated to the control group (C). There were measured: BW, Fat%, TBW, Hb, HCT and erythrocyte indices: RBC, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC). Based on Hb and HCT were calculated changes: blood (del BV%), plasma (del PV%) and cell (del CV%) volumes in C and S group. Before experiment all body components and hematologic indices were similar in C and S group. After 6 weeks of MonaVie supplementation no significant changes in body composition but significant decrease: (MCH), (MCHC) and an increase cell volume CV% + 2.89 ± 1.24% were found. In control group after 6 weeks period there were no significant changes in body components and hematological indices. These observations suggest that MonaVie supplementation does not induce significant changes in body composition and hydration status in young elderly women, however causes an increase of cells volume and a decrease of mean corpuscular hemoglobin concentration.

Keywords: body composition; total body water; women; supplementation; MonaVie juice

INTRODUCTION

The aging process is associated with several physiological and biochemical changes that may affect one's ability to maintain water balance and body composition. These changes involve: the loss of fat free mass (FFM) and increase of body fat (FM). Increase of body fatness in aging process is associated with a decrease of the basal metabolism as the result of sedentary life style (Evans, 1992; Chernoff, 2005; Roberts & Rosenberg, 2006) whereas the decline of fat free mass (FFM) is accompanied by a decrease of total water (TBW) content (Chumlea et al., 1999).

Many studies provide evidences, that body hydration status (cellular water content, TBW, FFM hydration) is not stable and decreases during aging process (Schoeller, 1989; Visser et al., 1997; Baumgartner et al., 1991). In addition to above information, others changes as: a decrease in sensation of thirst (Kenney & Chiu, 2001; Chernoff, 2005), alterations in plasma vasopressin effectiveness and concentration, a reduction of fluid intake (Elmadfa & Meyer, 2008), and a shift in the operation points for control of body fluid volume and composition (Mack et al., 1994; Sawka et al., 2007) were observed. Limited information is available on water intake, excretion and retention in older humans. Bossingham et al. (2005) indicated that healthy old women have maintain of water input, output and water equilibrium capable to younger adults and have no apparent changes in hydration status until 60 years of age (however TBW starts to decline after approximates 60 years of age) (Schoeller, 1989).

Fluid retention in the body depends on many factors. In the presence of sufficient substrates consumption and adequate amount of ingested drinks, body hydration remains at the relatively stable level in healthy people (under normal climate conditions and at the defined level of physical activity). The restoration of fluid balance following exercise induced dehydration is slower in older humans and depend on the electrolytes content in the drinks and solid foods consumed (Kenney & Chiu, 2001) after the exercise. Therefore, the addition of sodium and potassium to the ingested drinks and solid foods may be another important factor in the restoration of fluid balance following exercise induced dehydration.

It is known that the diets rich in fruits and vegetables may have beneficial effect on many physiological and biochemical processes. Less information is available on influence some fruits on changes in body composition and hydration in women after 60 years of age. In younger and older adults, fluid intakes, including water consumption ad libitum, depends on the fluid taste and feelings of thirst. Therefore interesting was determine the effects of fruit juice supplementation on a possibility of keeping water balance and proper hydration of body tissues in older women.

The MonaVie juice is a popular nutritional supplement prepared from the Acai berries. Acai provides many vitamins, minerals, antioxidant polyphenolics (primarily from anthocyanin) (Mertens-Talcott et al., 2008) and other nutrients necessary for health and cells regeneration. Xie et al. (2011) found that Acai diet, did not change body composition, despite a significant gain in body weight, and alter total cholesterol in ApoE deficient mice.

PURPOSE

The aim of this study was to determine the influence of 6 weeks of MonaVie juice supplementation on body composition and hydration status in young elderly physically active women.

MATERIAL AND METHODS

Sixteen women, students of The University of Third Age, were recruited for this study (age 61.11 ± 5.48 yr, height 156.33 ± 10.27 cm, body mass 70.45 ± 12.08 kg). Women were divided into 2 groups: 8 of them applied a supplement MonaVie juice (100 ml/d) (S) for a period of 6 weeks, while the eight other women were allocated to the control group (C).

Assessments of body components

Before and after 6 weeks in each group body mass and body composition were measured. There are various methodologies for determining changes in body components. Among them the hydrodensitometry (direct) method has been suggested as a gold standard for body composition assessments, however other methods as the bioelectrical impedance measurement methods BIA are also commonly used. BIA methods are applied not without objections, but are simple and not expensive to assess body composition (Heitmann, 1994), and can be performed across a wide range of subjects with regard to age, and body shape. In particular multi-frequency BIA (MF-BIA) method was described as a tool able to precise assessment of body components as: TBW, ICF and ECF (Volgyi et al., 2007). However, single-frequency BIA method (Tanita), incorporates age into their estimation of body composition and it is an alternative available option which has been used for estimating body components in young elderly women. Body mass and body composition: as: body fat (Fat %, Fat kg), fat free mass (FFM, kg), total body water (TBW kg, TBW/BM %) and body mass index (BMI) were assessed using bioelectrical body impedance (BIA) method, according to Tanita SC330 (Japan) system. Tanita SC330 body composition analyzer is a single- frequency BIA device that uses 4 polar electrodes. This device uses single-point load cell weighting system in the scale platform. An algorithm incorporates impedance, age and height is use to estimate body components. Body mass (BM) was measured to the nearest 0.1 kg.

Assessments of hydration status

The single frequency bioelectrical impedance assumes full hydration and so is unable to assess hydration status, therefore the total body hydration status was estimated on the basis of biomarkers of hydration status: urine specific gravity (USG) and total body water content (TBW) (Bossingham et al., 2005; Sawka et al., 2007). To evaluate a hydration of fat-free body mass the ratio (TBW/FFM) was calculated. In this study fasting blood were collected on day before and at the last day of 6-week's period. In the blood samples: hemoglobin (Hb), hematocrite (HCT), erythrocytes (RBC) and erythrocyte indicators: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) were measured, while in the urine samples the specific gravity was determined. Based on Hb and HCT values, changes: the blood (del BV%), the plasma (del PV%) and cells (del CV%) volumes, in C and S group, were calculated (according to the Dill and Costil formula 1974). Based on the ratio (del PV% / del CV%) the relative shift water for ECF and ICF space was calculated, for each tested group.

Assessment of physical activity

Daily physical activity was recorded by an accelerometer Actigraph GT1M (Manufacturing Technology Inc., FL, USA) worn for 7 days. For physical activity classification, healthy step goal 10,000 steps per day (Hatano, 1993) and more detailed Tudor-Locke and Bassett steps/day recommendation were used: <5000 steps/day – sedentary lifestyle index; 5000–7499 steps/day – low active; 7500–9999 steps/day – somewhat active; ≥10,000 steps/day – active; and >12,500 steps/day – highly active. Total daily energy expenditure was calculated according to the method prepared by manufacturer.

Statistics

The statistical package Statisica 9 (Stat Soft, 2009) was used for data analysis with significant level set at $p < 0.05$. Statistical analysis was performed with a one-way analysis of variance for determine differences between groups and pre- and after 6 weeks period in each group. Statistical significance was identified according to the Bonfferoni post-hoc test.

RESULTS

The analysis of subject's characteristics indicated that there are no significant differences in body mass and body composition before and after 6 weeks period between C and S group. According to definition BMI for older adults, only 5 women were optimal weight, while 4 were overweight, and 7 were obese (Table 1). The ratio of TBW/FFM was similar in all women (0.731 ± 0.01) and did not change after 6 weeks period.

There were no significant differences in body mass and biomarkers of the body hydration status: TBW, USG (<1.020 g/dm3) after 6 weeks in C and S group (Table 1), however supplemented women had a higher of TBW/BM, greater of D TBW% (+0.76 ± 0.22%), FFM and lower BMI (Table 1) after 6 weeks.

There were no significant changes in body mass and hydration status biomarkers after 6 weeks period in control group, however in C women was found a decrease of D TBW% (−0.54 ± 0.91%). Compared with C group supplemented S women had significant higher D TBW% after 6 weeks period ($F = 15.67$, $p < 0.05$).

Analysis of hematological indices revealed, that 6-week of MonaVie juice supplementation induces a small increase of RBC ($p > 0.05$) but a significant decrease: of (MCHC%) and an increase cell volume CV% +2.89 ± 1.24 % (Table 2). After 6 weeks MCHC% was significantly lower in S than C group of women (Table 2).

There was a significant difference in the relative ratio of water shift (del PV% / del CV%) to ECF and ICF space after 6-weeks between supplemented (0.60 ± 1.17) and control group (1.35 ± 1.79), ($F = 10.98$, $p < 0.01$).

According to daily activity monitoring, all women were moderately active per day (daily energy expenditure 1681.8 ± 297.6 kcal/d). Based on steps/day classification (Tudor-Locke & Bassett, 2004), one woman was classified as low active, nine women as somewhat active, four women as active and two as highly active. There was no significant difference between average steps/day values achieved by supplemented group (M ± SD = 9041 ± 1895) and control group (M ± SD = 9570 ± 1597).

Table 1. Subject's characteristics recorded before and after 6-weeks period in control and supplemented group of women

Characteristics	Women (n = 16)	Supplemented Group (N = 8)	Control Group (N = 8)
Age (y)	64.11 ± 5.48	61.85 ± 1.34	65.56 ± 7.45
Height (cm)	156.33 ± 10.27	158.86 ± 2.67	158.31 ± 2.91
Body mass (kg)	70.45 ± 12.08	69.34 ± 14.31[a] 68.87 ± 14.31[b]	71.82 ± 11.38[a] 71.46 ± 10.84[b]
Body Fat (kg)	27.59 ± 9.11	24.91 ± 9.73[a] 25.50 ± 9.98[b]	29.94 ± 8.82[a] 29.41 ± 8.80[b]
FFM (kg)	43.95 ± 5.26	44.43 ± 5.51[a] 43.37 ± 5.38[b]	41.88 ± 4.18[a] 42.04 ± 2.88[b]
TBW/BM (%)	44.94 ± 5.26	46.35 ± 6.16[a] 46.95 ± 5.31[b]	43.08 ± 4.52[a] 43.62 ± 4.83[b]
TBW (kg)	31.44 ± 3.09	32.74 ± 3.73[a] 31.71 ± 3.93[b]	30.55 ± 0.48[a] 30.76 ± 1.97[b]
BMI (kg/m^2)	28.65 ± 5.02	29.31 ± 5.93[a] 27.65 ± 4.94[b]	28.78 ± 5.00[a] 28.71 ± 5.01[b]

Legend: a – before experiment; b – after 6-week's period; FFM – fat free mass; TBW/BM – total body water / body mass; TBW – total body water; BMI – body mass index

Table 2. Changes in blood (BV%), plasma (PV%) and cell (CV%) volume, the number of erythrocytes (RBC) and erythrocyte indicators: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) before and after 6-weeks period in control and supplemented group of women

Hematologic characteristics	Women (n = 16)	Supplemented Group (N = 8)	Control Group (N = 8)
RBC	4.71 ± 0.28	4.61 ± 0.31[a] 4.82 ± 0.29[b]	4.70 ± 0.29[a] 4.75 ± 0.23[b]
Hb (g/dl)	140.09 ± 7.81	139.75 ± 6.27[a] 140.09 ± 8.58[b]	139.75 ± 9.07[a] 140.75 ± 8.63[b]
HCT (%)	41.61 ± 2.57	40.87 ± 1.9[a] 42.28 ± 2.28[b]	42.12 ± 2.1[a] 41.25 ± 3.0[b]
MCV (fl)	88.75 ± 2.91	90.25 ± 2.60 [a] 88.42 ± 1.71[b]	89.56 ± 2.83[a] 86.73 ± 3.32[b]
MHC (pg)	30.64 ± 0.93	30.61 ± 1.24[a] 29.39 ± 0.76[b]	30.06 ± 0.59[a] 29.73 ± 0.61[b]
MCHC (%)	21.07 ± 0.53	21.37 ± 0.32[a]⇓∞ 20.59 ± 0.31[b]	20.81 ± 0.37[a]⇑∞ 21.45 ± 0.60[b] **
MPV (fl)	9.50 ± 1.07⇑	8.88 ± 0.96[a]⇑∞ 9.01 ± 0.90[b]	9.67 ± 0.81[a] 10.42 ± 0.38[b]

Δ BV (%)	–0.18 ± 3.47	0.31 ± 3.98[a–b]	–0.68 ± 3.06[a–b]
Δ PV (%)	–0.20 ± 3.41	–0.89 ± 3.68[a–b]	0.49 ± 3.20[a–b]
Δ CV (%)	0.001 ± 3.55	+2.89 ± 1.22[a–b ⇑]	–2.53 ± 2.53[a–b ***]

Legend: * – Significantly different between S and C group ($p < 0.05$); ** – $p < 0.001$; *** – $p < 0.0001$; ∞ – Significantly different between a and b ($p < 0.05$), ∞∞ ($p < 0.001$), ∞∞∞ ($p < 0.0001$); a – before experiment; b – after 6-week's period; Hb – hemoglobin; HCT – hematocrite; RBC – erythrocytes; and erythrocyte indicators: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), changes in blood (D BV%), plasma (D PV%) and cell (D CV%) volumes

DISCUSSION

This study aimed to investigate the impact of 6 weeks of MonaVie juice supplementation on body composition and hydration status in young elderly women. Several body direct (BM, FFM, FAT, TBW, BMI) (estimated via BIA method) and indirect (TBW/BM, Δ TBW%, TBW/FFM – calculated), compounds were chosen to identify the influence of MonaVie supplementation. We indicated that MonaVie juice supplementation for 6 weeks did not influence on body mass and BM, FFM, FAT, TBW, BMI in young elderly women. Based on steps/day classification (Hatano, 1993), only 37.5% of women accomplished recommended 10,000 steps/day. Moreover, daily total energy expenditure level of the study participants (M ± SD = 1681.8 ± 297.6 kcal) was lower compared to 60–70 yr women in Johannsen et al. (2008) study (TEE ~ 2200 kcal/d).

In connection with aging process, many questions concern the tissue hydration stability (Wang et al., 1999) and maintain a proper body composition in elderly humans. Older humans are generally adequate hydrate but they are more susceptible on dehydration, because they have a slower water and sodium excretion and have a lower thirst (Sawka et al., 2007). It is know that the total amount of water in the body (TBW) is essential to a full description of humans body composition (Wang et al., 1999). If TBW values are available (by assuming that TBW is constant), estimation can be made for various body components including FFM, FM.

The fat-free body mass (FFM) hydration (TBW/FFM) is remarkably stable at 0.73, but may be decreased in elderly and in obese humans (Visser & Gallagher, 1998; Waki et al., 1991; Wang et al., 1999). The results of our study showed that regardless of apply a dietary of MonaVie juice supplementation or not, 65 years women had comparable body composition, fat-free body mass hydration before and after 6 weeks period.

Water is the most abundant ingredient in the humans body and it plays an essential role in the regulatory of cell volume, nutritional transport, waste removal and thermal regulation. Daily water balance depends on the net differences between water gain and water loss. Water gain occurs from consumption and production (metabolic water) while water loss occur from respiratory, gastrointestinal, renal and sweat losses (Sawka et al., 2007). Activation of homeostasis mechanisms to maintenance of body hydration usually occurs in stressful conditions. The stability of body weight for 6-weeks in both groups of women suggests, that supplementation not changes total body water content and body hydration status significantly, but may influence on a time course of rehydration and expansion of extracellular or intracellular fluid volume.

In many studies TBW has been expressed as the sum of water distributed in intracellular (ICW) and extracellular (ECW) space. The distribution of body fluid within the intracellular and extracellular compartments determines proper physiological processes. We indicated that 6-weeks MonaVie juice supplementation resulted in a significantly increase of TBW (+0.75% vs −0.54%, $p < 0.001$) and a significant increase of cellular volume (D CV%), and decrease of mean corpuscular hemoglobin concentration (MCHC%) and greater shift of water into cellular than extracellular space (D PV% / D CV %).

Changes of MVC (CV), MCHC and RBC may be good parameters to analyze quantify of RBC damage. It is known that older RBC with smaller size and higher hemoglobin concentration (MCHC) are destroyed faster than younger RBC with larger size and lower hemoglobin concentration. RCB cells deformability decides on their sensitivity to subhemolitic injuries associated with oxidative stress. Therefore, the results of the present experiment provide evidences that the MonaVie juice supplementation may induces some changes in the sensitivity of erythrocytes to harmful factors (preventing them from damage).

An important observation of the present study was to show the increase of cellular (del CV%) volume in women after 6 weeks of MonaVie juice supplementation. Fruit and vegetables are rich in potassium. The MonaVie juice is a supplement prepared from the Acai berries. Acai berries provide many vitamins, minerals, antioxidants. In 100 g Acai there is 932 mg potassium, 56 mg sodium and 1.02 g anthocyanins (Mertens-Talcott et al., 2008). It can be assumed that an increase of cell volume may be caused by the high potassium and antioxidants content in the MonaVie juice. Potassium is the major ion in the intracellular fluid and Maughan et al. (1997), Demigne et al. (2004) postulated that the inclusion of potassium into drinks consumed after sweat loss may aid in rehydration by enhancing the retention of water in the ICF space. On the other hand, a high content of antioxidants in the MonaVie juice could have a beneficial effect on cell volume by enter antioxidants to cells and better protect of cells from oxidative damage (Holderness et al., 2011). It may be suggested that increase of cellular volume (del CV%) and decrease MCHC% after the MonaVie supplementation in S women, similar as in Holderness et al. (2011) studies, indicated an improvement of protection erythrocytes from damage.

However, it is worth mention that low sample size tested women not allowing generalizing results of this study to whole population of young elderly women.

CONCLUSION

The results of this research suggests that 6-weeks of MonaVie juice supplementation did not influence body composition and total hydration status in young elderly women, however had an impact on cell volume (CV) and mean corpuscular hemoglobin concentration (MCHC). The increase of RBC, CV and decrease of MCHC observed after the 6 weeks of MonaVie juice supplementation in young elderly women causes changes in the characteristics of red blood cells, which provides evidences that cell (erythrocyte) protection has been improved.

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